
REPORT

OF THE

Special Commission appointed to inquire into the Causes of Explosion in Coal Mines.

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*To His Honour the Honourable SIR HENRI GUSTAVE JOLY DE LOTBINIÈRE, Lieutenant-Governor
of British Columbia :*

SIR,—On the 7th day of August, A. D. 1902, a Commission issued to us under the provisions of the "Public Inquiries Act," to inquire into and obtain information respecting the causes of explosions in Coal Mines and the means that should be adopted to avoid such explosions, and pursuant to the requirements of the Act we have the honour to report as follows:—

At a preliminary meeting it was arranged that Mr. Lampman, in addition to his duties as Commissioner, should also act as Secretary to the Commissioners, and pursuant to section 9 of the "Public Inquiries Act," Mr. L. J. Seymour was appointed Stenographer to the Commission and reported the evidence taken at the different sittings.

Notice of the Commissioners' first sitting was advertised in the *British Columbia Gazette* of 28th August, 1902, and in the *Fernie Press*.

Before the sitting in Ladysmith, notice was advertised in the Ladysmith "Leader," and before the sitting in Nanaimo, in the Nanaimo "Free Press." Owing to uncertainty as to the exact time of our sitting in Cumberland, and to the fact that the newspaper there is a weekly one, notice was not advertised there, except by the posting of notices in conspicuous places around the town.

Your Commissioners first visited Fernie, arriving there on Saturday, the 6th September, 1902. The Commission was formally opened on Monday the 8th, the Secretary reading the Commission, after which the Chairman stated its objects. After going through the mines at Coal Creek, Michel and Morrissey, we proceeded with the examination of witnesses, of whom 22 appeared and were examined, consisting of 1 Mine Inspector, 2 Mine Managers, 4 Overmen, 4 Firemen and 11 Miners.

Cumberland was the next place visited, where some of the mines were gone through and 20 witnesses examined, of whom there were 1 Mine Inspector, 1 Mining Engineer and Manager, 1 Mine Manager, 3 Overmen, 1 Shotlighter, 1 Timberman and 12 Miners.

We next went to Ladysmith, where the evidence was taken of 22 witnesses, of whom there were 1 Mine Manager, 2 Overmen, 8 Firemen and 11 Miners.

Nanaimo was visited last, and during 8 days there 25 witnesses appeared and gave evidence; the witnesses consisting of 1 Mining Engineer, 1 Mine Manager, 1 Mine Surveyor, 1 Mechanical Engineer, 2 Overmen, 1 Mining Instructor, 6 Firemen and 11 Miners. In addition to these the Manager of the Hamilton Powder Company's Works, at Northfield, gave evidence, and Inspector Morgan, who had already been examined at Cumberland, was re-called.

Many of the witnesses who have been classed as Overmen hold Managers' Certificates, and many who have been classed as Firemen hold Overmen's or Managers' Certificates, the classification being given according to the position the witnesses held at the time.

While at each of the last three places visits were made to some of the mines.

At all of the mines both the officials and the miners entered into the spirit of the inquiry and afforded us every facility in making a personal examination of the mines and getting evidence.

Your Commissioners in making their report think the most convenient arrangement will be to deal with the different matters on which evidence was given under different headings, as follows—

VENTILATION.

The question of ventilation is probably the most important in connection with coal mining, for two reasons: first, because it is imperative to have a sufficient supply of pure air to insure

the health of the workmen ; and second, because the volume should be such as to sweep away any gases, whether explosive or not, which may be given off from the workings. This is provided for by Rules 1 and 2, section 82, of the Act.

With the mechanical appliances now in use in the various coal mines of the Province, there is no reason why a supply sufficient for all purposes should not be passed through the workings, providing proper attention is paid to the intake and return airways and the law relating to splits is carried out ; and here we may mention that from the evidence given before us, it appears that the provisions of Rule 68 of the special rules, forbidding the deposit of obstructions and rubbish in the air-courses and roads, do not meet with the strict observance their necessity calls for.

At some of the collieries visited by your Commissioners the sectional area of the airways was rather contracted for efficient service, but we were pleased to note that extensive operations were then in progress to remedy this defect. We cannot deprecate too strongly the dangerous practice of opening up what may become an extensive colliery with narrow and contracted intake and return airways.

In an intake airway of insufficient area it is impossible to pass a volume of air in such quantities as to insure safety without increasing the velocity to such an extent as to become, in a dry and dusty mine, a source of danger.

In extensive mines where mechanical haulage is employed, it would vastly improve the system of ventilation if the intake airway was divided into two parallel drifts, or some other means adopted whereby there would be an intake airway independent of the main haulage way, and especially where electric motors are used, as the motors and the train of loaded cars almost fill the area of the roadway, and when going at a high rate of speed very materially obstruct the free passage of the air currents.

In this connection it may be well to state that care should be exercised in having good airtight stoppings between the main intake and return airways, so that the quantity of air may not be reduced before reaching the working faces.

In at least one place visited we found the pillar of the main intake frequently perforated with openings or cross-cuts from what was practically the old workings. This was not only a source of danger, but it would be almost impossible to conduct the air current without material leakage. We would recommend that between main intake and return airways cross-cuttings should be as far apart as possible.

There is another point which we deem of sufficient importance to recommend its being made part of the Act, and that is that the intake and return air pass through different mine openings ; in other words, that a certain distance of natural strata shall intervene between the intake and return. Probably the intention of section 24 was to meet this requirement, but mines are operated where the intake and return air currents are divided only by a board partition in the shaft. The Act should be clear on this point.

As furnaces are not now used nor likely to be used in this Province, it is not necessary to say anything in reference to them. Fans are universally used, many of them of the most modern pattern, and in every instance where permanently placed the usual precaution is taken to prevent injury in case of an explosion. It would be conducive to the safety of mines if there were two fans, so that in case of injury to one the other would be available. This would be desirable at all mines, but in the case of fiery mines we consider it very necessary.

Where the two fans are not considered absolutely necessary there should be two engines, each capable of working the fan on opposite sides.

DUST.

It is now generally admitted that coal dust is explosive even in the absence of gas, and, consequently, a source of danger, and nearly every witness seemed thoroughly alive to the importance of watering as a preventative of an explosion.

The origin and conditions of a fire-damp explosion have for a long time been matters of general knowledge amongst miners, but the dangers of coal dust are of more recent discovery. That fire-damp is not an essential element of an explosion is evidenced by the fact that an explosion occurred in November, 1893, at the Camerton collieries, Somersetshire, England, in a mine altogether free from fire-damp. Similar explosions have occurred, such as at Timsbury and Pocahontas.

The evidence taken was to the effect that a system of watering dusty mines was necessary and should be made compulsory, but there was some diversity of opinion as to the best system.

There was, however, practically a unanimity of opinion that watering by buckets is almost sure to be inefficient, and in this regard we entirely agree with the remarks of Mr. J. S. Martin, one of His Majesty's Inspectors of Mines, who, in reporting to the Secretary of State for the Home Department on the circumstances attending an explosion which occurred at Llanbradach Colliery, Llanbradach, near Cardiff, on the 10th of September, 1901, used the following language:—

“The method of watering by barrels is in use very extensively in the district and has been maintained to be satisfactory, the water being distributed by flexible pipes attached to the barrel, or by buckets. It is a system which would allow of the places being thoroughly watered, but it has never presented itself to me as altogether satisfactory, owing to the human element in the arrangement which seemed likely to render what was ‘possible,’ ‘not probable.’ I have, however, always been told that the watering was done thoroughly whenever I raised the question, casually, upon making inspection at mines. There no longer seems any grounds for considering it satisfactory, and I think colliery managers and workmen must in the future more thoroughly recognise the danger arising from dust, and introduce some satisfactory means for bringing a jet of water to play upon the roof and sides. Where the water has to be conveyed in barrels or tanks, they must see that a much greater supply is provided, and that some kind of hand pump is used for applying it. It must also be borne in mind that where there is much dust, water takes little effect at first, and that it must be very liberally distributed for its use to be efficient.”

Professor Galloway, an eminent authority on coal dust explosions, specifies five systems of watering mines, namely:—

- (1.) Water tanks hauled along the mine railways, provided with a pipe pierced with holes;
- (2.) Sprays produced from very small nozzles fixed to vertical stand pipes fixed to a water pipe laid along one side of the haulage way;
- (3.) Similar sprays in which compressed air is employed for the purpose of pounding the water into very fine particles;
- (4.) A water hose, 30 or 40 feet long, attached at one end of a short stand pipe connected to a water pipe lying along the road;
- (5.) The exhaust steam of a constantly working engine, such as the engine of a ventilating fan, introduced into the intake air as it descends the downcast shaft.

Of the different systems, most of the witnesses preferred the sprays as mentioned in clause two, and from our personal observation and from the evidence given before us there seems no reason why such a system should not be adopted without causing any injurious effect to the roadways.

In addition to the foregoing systems, which seem to deal principally with the watering of main roads, it is imperative that the system adopted should be continued so that the water is carried to and around the working faces, as it is there the great danger arises, owing to the use of explosives. It is at the working faces that a mixture of fire-damp and coal dust in suspension is most likely to be met with, and authorities are agreed, after a series of experiments and demonstrations, that a small percentage of fire-damp, say 2 per cent. or even less, which of itself is harmless, may, with coal dust in suspension, become highly explosive and especially dangerous in the case of a blown-out shot.

It is conceded that all coal dust is not explosive, but we have every reason to believe that at all the collieries in this Province the dust, under certain conditions, is of an explosive nature. The experiments made by your Commissioners were of the crudest character, yet they were sufficient to prove that dry dust will easily ignite.

It is impossible to prevent entirely the accumulation of dust, but a great deal could be done to prevent the danger arising from its accumulation; for instance, the cars, as far as possible, should be dust-proof, and personal observation convinced us there was room for improvement in this direction. In some places in Great Britain, as an extra precaution, they are watering the full trains before they start on their journey to the surface.

EXPLOSIVES.

The use of explosives in coal mines deserves the most careful attention. The ordinary black blasting powder now in use is generally admitted to be dangerous under certain conditions. In the coal fields of British Columbia an explosive of some kind is necessary. Where safety lamps are required the use of black powder should be prohibited. The many contriv-

ances invented for getting coal, such as the lime cartridge, compressed air cartridge, the wedge, etc., would be useless, owing to the nature of the coal seams. It therefore follows that where black powder is prohibited some substitute must be adopted. The Government of Great Britain have adopted what is known as a permitted list of explosives, a system which we strongly recommend be introduced in this Province.

Evidence was given showing that there was a difference in the strength of explosives now in use, although sold as of the same grade, and for this reason a danger; therefore, we believe there should be Government inspection or supervision of all explosives used in coal mines, and the composition and date of manufacture marked or stamped on the keg, case, cartridge or package, as the case may be.

We believe that Rule 9 of section 82, respecting the carrying and storing of explosives, and especially dynamite, is most rigidly observed. This explosive should be taken into the mine in a protected case only, and never when in a frozen condition. It should be wrapped so as to protect it from freezing after being brought in. Thawing in the mine should be strictly prohibited, unless proper appliances are provided for that purpose.

BLASTING.

Blasting is, no doubt, the greatest danger to be contended with in coal mining. Probably most explosions can be traced to the agency of blown-out shots, and for this reason every precaution should be exercised to prevent their occurrence. It is established beyond doubt that in a mine of a dry and dusty nature a blown-out shot is liable to create an explosion even where no fire-damp exists. This danger is now fully recognised amongst the miners themselves, as their evidence shows. For the purpose of carrying out the rules governing blasting the shot-lighter should be a thoroughly competent and reliable official. He should see that the coal is well prepared and the shots properly placed; that the boreholes are well cleaned; he should examine the quality and quantity of explosives used; he should see that coal or coal dust is not used in the tamping and that the augers used in boring are as nearly of a uniform size as possible.

The method and quality of tamping are very important, and some suggested that only a clay or a suitable shale should be used for that purpose, and none of the witnesses could remember of having had a blown-out hole with clay tamping.

He should see that sub-section (1b) of Rule 9 of section 82, in relation to the watering of the place, is fully carried out, and refuse to fire shots unless the suggested precautions are observed.

We recommend that the Act should be made clear so as to provide that all holes should be examined by the shot-lighter before charged, and that the place should also be examined by him after the shot had been fired, as blowers of gas may have been liberated and the ventilation interrupted by the shot. The great majority of witnesses were of opinion that this would add to the safety of the mine. It is true some objected to it, but we think their objections were based on a not unnatural desire to be unmolested in their work.

In mines where safety lamps are considered necessary the shot-lighters should be provided with some sort of shot-firing lamp. The present system of opening the lamp to light squibs or fuses is not conducive to safety and should be prohibited. Of course it is understood that the fire-man or shot-lighter will not open his lamp unless he knows there is no gas present, but the practice has a tendency to make miners less careful in exposing a naked light, as when a miner sees an official opening a lamp for this purpose he might conclude, with some reason, that there would be no harm in his lighting a pipe and smoking. To obviate this danger, we would recommend that shots be fired by electricity. The evidence was practically unanimous that where safety lamps were necessary, nothing but explosives of a permitted list should be used.

In the use of explosives in leading places extra precautions should be taken, and we cannot emphasise too strongly the necessity of only men of acknowledged skill and experience being employed at such work.

ELECTRIC APPLIANCES.

In a dry and dusty mine, giving off gas to such an extent that safety lamps are necessary, electric appliances, such as motors, hoists and pumps, should be prohibited. Exceptions might be made in the main intake airways, but in no cases should such appliances be used in the return airway of a mine giving off inflammable gas. This is not only the opinion of your Commissioners, but the evidence given was almost unanimously to the same effect.

FIREMEN.

In mines giving off gas, it is highly essential that the examination of the working faces, roads and airways, should be thorough and frequent, and for this purpose the Act, in our opinion, is not sufficient. Rule 3 of section 82 provides that in a mine in which inflammable gas has been found within 12 months, an examination shall be made before the time for commencing work. The evidence showed at some mines that this was construed so as to permit of such examination as much as 7 hours or more before the workmen entered the working places.

We, therefore, recommend that the rule should provide that the examination should be made not more than $2\frac{1}{2}$ hours before the time of the workmen entering, and less where deemed necessary. The rule should be applicable to all coal mines in the Province, irrespectively as to whether or not inflammable gas has been found within the preceding 12 months. It should be an offence against the Act for a fireman, or anyone else, to attempt to remove a body of gas of any quantity by any means other than ventilation.

To fully carry out the onerous duties of fireman, it is necessary that he should be free from physical disabilities, and it is especially necessary that his eyesight should be good, and for this reason we would recommend that the amendment to the Act (1901) governing the examinations be amended so that firemen and shot-lighters, before being granted certificates of competency, be required to furnish the examiners with a certificate from a competent person that their eyesight is in good condition.

It is claimed by authorities that with the lamp now in use by firemen it requires a practised eye to detect two per cent. of gas. This would lead to the inference that a greater percentage would go undetected by a fireman with defective sight. While two per cent. of gas in the atmosphere may not be considered dangerous, it is acknowledged that if, in addition, there is dust in suspension, the danger point is reached in the event of a blown-out shot.

Under this head we wish to say that it is full time a lamp of a more modern pattern, and one that will detect a smaller percentage of gas, be furnished by mine-owners for the use of firemen. There are several such lamps on the market, and it is claimed for them that they will detect as low as one-quarter of one per cent. of gas.

In addition to this, gas-testers of acknowledged efficiency should be kept at the colliery, for the use of the Manager and the Inspector, by which frequent tests could be made in the return airway and the results noted and recorded in the fireman's report book. We also think the fireman's lamp should be furnished with a re-lighting apparatus, so that in case of the light being extinguished the lamp could be re-lighted without being opened.

The present practice of firemen in making their examinations is to carry an unlocked lamp, and in case of their lights going out to open the lamp and re-light with a match. This is a dangerous practice and should be prohibited.

The intention of Rule 3, section 82, would appear to prohibit the allowing of miners or others to work at the faces where inflammable gas is found. It would not be complying with the spirit of the Act and the rule to allow work in such places, even though safety-lamps are used. We have reason for believing that Special Rule 33 is not always strictly observed, and as it is very important for the general safety of the mine that the rule should be strictly observed, the Mining Inspector should make special inquiry as to this and enforce the rule.

SAFETY-LAMPS.

There was a great diversity of opinion as to the merits of the different lamps, about which your Commissioners have nothing to say, except that they do not find that any of the various kinds of lamps now in use in the Province can be classed as unsafe. In the cleaning and trimming of the lamps great care should be exercised, as otherwise a miner may take into the mine a lamp in a defective condition. We recommend that all safety-lamps be tested in an explosive mixture before being given out to the workmen.

Doubtless there would be fewer accidents from fire-damp explosions in this Province if safety-lamps were entirely used, but the accidents from other causes would inevitably be increased to such an extent that we hesitate to recommend their exclusive use. We see no reason why, with an adequate supply of air properly conducted around the working faces, thorough examinations and supervision by the mine officials, discipline on the part of the workmen strictly enforced, safety explosives only used, roads and airways and working faces kept in a moist condition, that open lights could not be used with comparative safety.

WORKING MORE THAN ONE SHIFT.

The working more than one eight-hour shift in every twenty-four hours has received considerable consideration. The consensus of opinion was against three shifts under any conditions, except, possibly, in leading places. There was some diversity of opinion as to whether a second shift would create any additional danger, but, on the whole, there was but little objection to the second shift, provided the mine was well watered and ventilated. In mines, however, giving off large quantities of inflammable gas, and where the coal is of a soft and friable nature, the working of two shifts in succession may be a source of danger. In cases of this kind, of which the Inspector should be the judge, and where it is found necessary to work two shifts, we would recommend that some mutual understanding be arrived at between the workmen and the management so as to allow an interval of some hours to elapse between shifts.

PANEL SYSTEM.

Where the panel system of mining can be adopted it would undoubtedly add to the safety of the mines, and with the suggested precautions should render us practically free from these disastrous explosions unfortunately so frequent in our coal fields. We are aware that the coal fields of this Province are broken, and in some cases the system would be almost impossible, but in many places it could be worked to advantage. The advantage of this system is that it does away with the necessity of so many doors in conducting the ventilating current. Doors on main roads and important haulage ways must be considered a source of danger, and the aim should be to have as few as possible.

OLD AND ABANDONED WORKINGS.

What are known as old and abandoned workings must always remain a source of trouble to mine managers, and the question as to the best remedy to overcome the trouble and remove the danger is as yet an open one. The great majority of the witnesses were in favour of rendering old workings harmless by having sufficient ventilation passing through them; but while this view cannot be combatted, the fact yet remains that in many cases it is almost impossible to carry it out, owing to caves and falls obstructing the airways. The only recommendation we can make on this head is that, where possible, the ventilating process should be used, otherwise secure and airtight stoppings should be erected.

STOPPINGS.

On the question of stoppings a diversity of opinion existed amongst the witnesses, some maintaining that they should be built of stone, others that they should be of brick, but probably the majority were in favour of wooden blocks. While not expressing an opinion as to which is the best, we may point out that any one of the different kinds mentioned would meet all requirements if properly constructed. It is yet an open question whether all stoppings should be built so as to be explosion proof or not.

EXAMINATIONS.

A mine cannot be considered safe unless the officials and workmen are practical and competent, and to insure a greater efficiency in this respect we recommend some changes in the existing regulations. At present a candidate for a mine manager's certificate is required to have had only two years' experience in or around a mine; it is not required by the Act, but is a rule of the examiners. This time is quite inadequate, and all are agreed that it should be extended, and that the change should be embodied in the Act, and we recommend that the required experience in and around coal mines be five years.

We also wish to point out that all are agreed that men cannot with only one year's experience become qualified to act as overmen, firemen and shot-lighters, and we recommend that a certificate of competency as overman be not granted to any one who has had less than five years' experience, and that a certificate of competency as shot-lighter or fireman be not granted to any one who has had less than three years' experience.

We also recommend that overmen and firemen should be examined by the same Board of Examiners as the manager; at present the Board contains two miners, and we share the opinion of the miners generally that no official should be examined by another official of a lower standing.

There is a prevailing opinion that the class of labour employed in the mines of this Province may have had something to do with the high rate of accidents. Whether the theory is a correct one or not we are unable to positively state, but there can be no division of opinion that an intelligent class of labour is in every way preferable.

British Columbia is handicapped, owing to the scarcity of skilled miners, differing in this respect from old mining countries where most of the miners have had experience since boyhood.

Many witnesses went as far as to say that all employees in a coal mine should be able to read and write in the English language. However that may be, we have no hesitation in recommending that the late amendment to the Act governing the examination of miners and others be amended so as to require that all the employees in the mine be able to intelligently understand orders given in English. There is a rule in the Special Regulations for the working of coal mines in the Kingdom of Prussia which might well be embodied in the Special Rules of this Province. It is as follows:—

“Care must be taken that workmen who cannot read are instructed as to regulations pertaining to their labours. The mine owner or his representative is responsible for the execution of this regulation.”

Section 42 of the Act provides for the cancellation or suspension of the certificate of a mine manager if it is deemed he is unfit to discharge his duty by reason of incompetence or gross negligence, or of his having been convicted of an offence against the Act, but there is no corresponding provision whereby the certificates of overmen, firemen, shot-lighters or miners may be suspended or cancelled. The provision should extend to all having certificates, for at present a man might be convicted of some act endangering the lives of those in the mine, but it would still be open to him to obtain employment at another colliery, on production of his certificate of competency. A man too careless for one mine will likely carry his careless habits with him to another.

DISCIPLINE.

Even where every appliance is available it is important that strict discipline be observed amongst both officials and workmen. The official that is not amenable to discipline himself, or cannot maintain it amongst those under him, should have no place in a coal mine. The trapper boy, by disobeying an order, may be the cause of a disastrous explosion. It follows that it is important that all should have sufficient intelligence to fully understand orders and instructions, and that they should be impressed with the necessity of strict obedience. To enforce the Rules and Regulations it should not be left entirely with the officials and the Inspector, but each individual should be a watch on his neighbour and report to the management any violation of the Rules.

CONCLUDING OBSERVATIONS.

It is often exceedingly difficult to determine the cause of an explosion, the evidence of experts being often so conflicting both as to the cause and the initial point.

The conditions which render a mine dangerous may be summarised as follows:—

The atmosphere gradually becoming saturated with inflammable gas; sudden outbursts of gas; and dry and dusty roadways, working faces and air passages.

The causes which would create an explosion where these conditions exist are naked lights; defective safety lamps; flame from shots; concussion from blown-out shots or volley firing; accidental ignition of explosives; and lightning entering the mine.

While it is generally conceded that the coal mines of British Columbia generate inflammable gas, yet the investigations into the different explosions which have taken place in the past point to the fact that coal dust, and not fire-damp, was the main factor in these catastrophes. With possibly one exception, the mines were working as usual, and, according to the reports of the firemen, were practically free from gas; the evidence showed that watering had been done in compliance with the Rule in the Act governing the same, yet a dangerous condition must have existed or the explosions would not have occurred. This shows that the precautions heretofore taken have been inadequate; but even where all precautions are taken it is doubtful if we can ever become entirely free from explosions, and for this reason there are some appliances which we recommend should be provided so that they may be used in case of accident. Instances are on record of where lives might have been saved if the victims of an explosion had been conversant with the avenues of escape; there are also instances of cases in which if a light could

have been obtained, such as that supplied by the re-lighting attachment of some safety-lamps, it would have aided in saving life. Some of the workmen in each section of the workings should periodically be instructed in the means of escape. Material for quickly replacing stoppings and respirators or other contrivances for entering foul atmosphere should be kept on hand.

The fatalities from explosions and other causes in the mines of this Province have been extremely high, as the following statement prepared for us by Inspector Morgan shows:—

“Number of fatalities for every 1,000,000 tons of coal produced in Great Britain, Pennsylvania and British Columbia for ten years.

“In Great Britain, for ten years, 1890 to 1899, inclusive, there were 2,032,810,544 tons of coal produced. During this period there were 9,036 fatal accidents, 1,269 being caused by explosions and 7,767 by other causes, showing that for every 1,000,000 tons of coal there were .624 fatalities from explosions and 3.328 deaths from other causes.

“In the State of Pennsylvania, according to the report of the Bureau of Mines, Harrisburg, Pa., the amount of coal produced was 1,132,396,728 tons for the years 1892 to 1901, inclusive, a period of ten years, while during this time 5,713 fatal accidents occurred, 470 being caused by explosions and 5,243 by other causes, so that for every 1,000,000 tons of coal produced there were .415 fatalities from explosions and 4.63 deaths from other causes.

“In the Province of British Columbia, for the period of ten years, 1892 to 1901, inclusive, there were 188 fatalities, while the amount of coal produced was 10,878,427 tons. Out of the 188 fatalities, 72 were caused by explosions and 116 by other causes. There were 6.618 deaths by explosions for every 1,000,000 tons of coal, and 10.663 fatalities from other causes for the same amount of coal.”

These figures disclose the fact that the fatalities in British Columbia from causes other than explosions were almost double those caused by explosions, thus shewing that explosions are not the only dangers to be contended with.

In the following paragraphs we give a summary of the most important subjects dealt with in our report and the recommendations based on them:—

Ample ventilation in moderate velocity to sweep roadways and working faces.

Copious watering of all working places and roadways, where necessary.

Explosives similar to those on the permitted list in Great Britain only to be used, except in mines or parts of mines naturally wet and free from fire-damp.

Government inspection of all explosives used in coal mines

Shots to be fired by official shot-lighters and then only when well prepared and properly placed.

Shots to be tamped with clay, suitable shale or some other non-inflammable material and fired electrically.

Prohibition of volley firing in stone drifts or other places connected with a dry and dusty mine.

In work involving extra risk and responsibility, only the most competent and reliable workmen to be employed.

Exclusion of all workmen from the mines who cannot intelligently understand orders and instructions given in the English language.

Strict enforcement of all Rules and Regulations, with rigid discipline generally.

Systematic inspections of each mine by the workmen, as provided for by Rule 31 of section 82 of the Act.

All of which is respectfully submitted.

We have the honour to be,

Sir,

Your obedient servants,

JOHN BRYDEN,
TULLY BOYCE,
P. S. LAMPMAN.

Victoria, 18th February, 1903.

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