Part II: Chapter V.

Morphology of Accidents, 1900—1950s

Two varieties of accidents are common in the collieries. One is natural (geological as well as mechanical) and the second is man-made. Most contemporary accidents are pre-eminently man-made. The engineers in the mines planned without taking into account the wisdom of experienced miners, without heeding their knowledge about how to control accidents and ensure safety.

(A common opinion shared by the knowing miners in the Jharia coalfield.)

The morphology of accidents expresses social and physical contours of workplace risk: the loss of natural and social assets, social and emotional vulnerabilities, geophysical and mechanical susceptibilities. I have discussed the first two issues in the last chapter. This chapter will engage with the third element.

Accidents were of three varieties: geophysical, mechanical, and human-constitutional. The first is connected with the objects of labour like pits and quarries; the second with the instruments of labour — machines and their maintenance; and the third with the human and physical constitution of labour. My aim in this chapter is to grasp the way mining industrialists worked out the relationship between these factors in their effort to ensure safety.

In developing my argument, I will locate myself within a tradition that seeks to critique technological determinism and the deification of technology as the panacea of all the social problems. Virilio (2008) has pointed out that all modern technological developments and techno-centric resolution to developmental problems create potential hazards. The occurrence of an accident, in fact, expresses the original [hidden] substance of that knowledge. The reason for this, according to Virilio, is that the application of technological knowledge produces a set of characteristic lags. There is, first, a lag between the time when a new technology is introduced and the time when common
people come to grips with it. Second, there is a lag between the occurrences of mechanical hazards the development of requisite technological knowledge to prevent them. This chapter attempts to locate these lags, and understand how industrialists sought to address them.

Chart I. Official Classification of Geological and Mechanical Sources of Fatalities in the Coalmines (CIMARs)
Roofs that fall

The coal-seams in a pit, on an incline, and in a quarry – studded with particular geophysical property and maintenance requirement – constituted the object of labour in the coal industry. The thick seams found in the Jharia coalfields were usually mined through the board/stall and the pillar method. The miner extracted coal by cutting a network of rooms or galleries into the coal seam, maintaining pillars of coal in a chequerboard fashion to keep up the roof. There were further propping arrangements to support the roof. Usually pillars could make up to 40 percent of the total coal in the seam depending on the geophysical environment. These were excavated in a second working, involving thinning down and removal of pillars. This cutting of coal created a gravitational tension in the roof of a coal-seam. So the miners put up props to support to help ease out the geo-structural tension in the roof. This process is known as timbering. Sparse timbering allows the coal-seam to release the geo-structural tension by shedding some amount coal and stone. When stones or coal fell from colliery roofs, or sides, or working faces – caused by the geophysical turmoil – miners were often hurt. Accidents were thus a persistent possibility, both underground and in surface workplaces.
I. A Miner Cutting Coal
II. A gang of miners walking over an incline to reach the seam

About forty-six percent of the total fatalities in the early years of the twentieth century were caused by the collapse of the roof, the side, or the face in a colliery. Subsequently the proportion went up to more than fifty to sixty percents in the decades between the 1920s and the 1950s. At that time, all over the mining world, roof or wall collapse was the primary cause of accidents. On February 11, 1899 in the Kalikapur Colliery in Raneegunge, managed by N. Banerji & Brothers, four miners slogged to break down coal from the roof. When tired, they sat down to rest for a while, unaware that they had already loosened the roof-coal and large chunks of coal were hanging over their heads. As the roof collapsed, two of the miners – John Bauri and Bipun Bauri – were crushed to death. The other two were seriously injured. Sometime miners had to
work so close to the roof that they could not perceive the danger of roof collapse.
Consider the following case reported in 1907, in the Khas-Jharia mine:

Deceased was ordered in a seam, which is 26 feet thick, to cut down some roof coal and had apparently been at work for three hours when some of it came away suddenly and injured him so severely that he died in a few minutes. The place was so high that he had to stand upon a stool, and doubtless he was not able to perceive any sign of fracture or detect any movement in time to get out of danger.\(^4\)

Collieries usually fenced off a certain areas, known as goaf. This was a place, which did not have timber supports, and the roof coal was expected to fall freely. No one was supposed to enter this space. However, operators often ordered colliers into this forbidden space. At Katras colamne, managed by Nowagarh Coal Company Ltd., for instance, one miner lost his life in 1918 when the supervisor sent him beyond the fence to collect stones from a goaf for building material; and there a heavy roof fell on him.\(^5\)

The systematic arrangement of timber supports for the roof required expertise and care. Engineers and colliers had to judge where to place the support, and how many planks to put. Carelessness and lack of proper supervision led to many accidents. Inspection reports of the mines regularly reported incidents like the following that took place in the Chota Dhemo Coalmine in 1907:

Deceased was loading coal in his working place beneath some roof coal which was overwhelming for 5½ feet, when the latter fell upon him; his leg was so badly mutilated, and he was otherwise so bruised, that he died the same day. The sirdar appears to have told a mistry to set any props that might be required, but gave no definite instructions about either supporting or getting down the roof in this place. His inspection should have shown him the necessity of having the roof coal taken down and he ought to have given instructions accordingly (CIMAR, 1907: 3-12).

The link between roof collapse and bad propping arrangements became even stronger as mining moved deeper and farther away from the face. The wooden propping required adequate supply of timber, and careful vertical and diagonal placing of timber to weave a web. This was essential to create a strong support that could bear the burden of altered
geophysical tension of the roof. In addition, there was a need to forge a fine balance between timbering and arrangement of pillars, galleries, and mining level.\textsuperscript{6}

Miners extracted coal, at times, from all sides of colliery galleries and pillar, compounding the problem of support to the colliery roof. Sometimes, to fill the tubs quickly they attempted to get coal from the pillars left to provide supports to the roof. In official technical language, this is termed pillar robbing. It is different from the act of pillar winning or de-pillaring, which a colliery undertakes in the second stage when it has already exhausted gallery coal. Pillar robbing often happened without the construction of alternative supports. Therefore, pillar robbing and reduction of pillars to a thin size in the first working of coal seam aggravated the danger of accidents. Unable to bear the weight of heavy roofs, the thin pillars regularly collapsed. The process of pillar winning in the second phase of mining required careful deliberation over what could be considered safe and proper. The standard method was ‘pickering’ (CIM). Suggested in 1908, this method required that de-pillaring (partitioning of the pillar and serial attacks) be carried out in a phased manner, and be accompanied by adequate timbering. The pillar-winning stage was full of danger. Accidents could happen due to a variety of causes. When in 1907 three miners died in a roof collapse in the Bhaga mines of Jharia Colliery Company, the official report pointed to a range of possible reasons for the accident:

\begin{quote}
the pillars were being extracted in a 24 feet seam, and some power shot had brought down a quantity of coal from the corner of one pillar. The deceased men were supposed to be filling out this coal. After the accident, it was found that a large quantity of coal had fallen from a pillar at the opposite side of the gallery to that from which the coal was blown down, and two of the five men working were caught by it and killed. ...It is possible that the former pillar was somewhat crushed by weight, and perhaps the blasting may have further shaken the coal. But, the most probable reason is that the deceased men were trying to get down some coal from the wrong pillar, and it came away suddenly and caught them (CIMAR, 1907: 3-12).
\end{quote}

The Jharia coalfields steadily shifted, at the time of WWI, from one form coal cutting to another – from gallery carving method to pillar winning. This led to a surge in accidents. The Charanpur coalmine (Reliance Coal Co. Ltd.) saw attempts to win the
pillar, 14 feet high, in the crude undercutting manner, thereby resulting in the loss of one collier:

...the system being to undercut the coal near the floor and then let the roof coal fall. The undercutting had been taken 5 feet in and the only support consisted of three or four vertical props. A large piece of roof coal fell from between two slips, swaying out the props, and killed one of the miners. It had been pointed out before that when pillars are being got in this way, it is not sufficient to support the top of coal with vertical props only. Unless diagonal struts are added, there is always danger of a big collapse.7

Pillar wining on the stocks principle, recommended by G.F. Adams (CIM) in 1919, may not also be entirely safe, if the geophysical fault line passes through the roof rocks. At Kustore South Coalmine (Raneegunge Coal Association Ltd.), three coal-cutters were entombed on February 12, 1921, when they were extracting pillars on the stocks principle. One of the dead was Mahabir Meah, forty-five years of age, another was Bhunsi Meah who was fifty years old, and the third was Lukan Manjhi a young man of twenty-five. The report said:

The coal seam is No. 15 seam, 20 feet in thickness. In the first working pillars, 45 feet square, had been formed by driving galleries, 15 feet in width. The extraction of these pillars was in progress. The method adopted was to divide a pillar into four equal portions or “stocks” by splitting it into two directions, and to take out the “stocks” one by one in rotation. An area, about 300 feet by 200 feet, had been depillared successfully. ... A pillar had been split forming four “stocks” in the usual way. The first “stock” had been extracted and the timber withdrawn. The second “stock” had also been extracted, but the timber had not been withdrawn. The third “was then attacked, but, owing to a “fault” which passed through it, the manager decided to leave it until the fourth “stock” had been extracted. The extraction of the fourth “stock” had proceeded until it had been reduced to dimensions approximately 11 feet & 7 feet when collapse took place with so little warning that three of the eight miners at work were unable to make their escape and were buried. The fall measured 60 feet & 47 feet, and previous to the collapse it was supported by the “stock”, 11 feet & 7 feet, and by props the number of which was variously stated to be not less than 26 and not more than 40 (Simpson, CIMAR, 1922: 10).

The Mines Inspector on inquiry opined: ‘Successful extraction of pillars by this method requires that the splits should be kept as narrow as possible. The timbering should be
sufficient and regularly distributed, and as the extraction of coal proceeds the timber should be withdrawn in small sections so that there is never any large area of roof standing on timber.' He recommended that the rules for coalmines should specify that Mangers in consultation with the Inspectorate would draw the plans for winning pillars. The recommendation it was finally legislated in 1936-38.

The fatality and injury rates per ton of coal raised were comparatively high in Indian coalfields. One of the reasons was that Indian miners, excluding the supervisor and manager, did not wear shoes and helmet. R.R Simpson (CIM) recommended in 1924-25 that the coal company should arrange shoes for the miners to help them protect their toes. Similarly, W. Kirby (CIM) recommended in 1939-40 that miners should at least have bamboo helmets to stave off injuries caused by the fall of ordinary coal pieces. The situation did not improve much until the early 1960s. The First Safety Conference, held in the Republic of India in 1958, impelled the companies to invest in shoes, mining clothes and steel helmets. The companies asked miners to purchase these at concession rates from the company stores. Only a few miners were willing to spend their earnings on safety instruments.

Miners in the quarry and on the surface were also vulnerable to the collapse of working faces and subsidence of the ground. Three colliers, called “coolies” in the official parlances, lost their life in Sudamdeeh quarry in 1900, when an over-hanging roof fell on them. Explaining the incident, the Mines Inspector said that at the place of collapse ‘the coal dips at about 48 degree, and had been partly excavated leaving an over-hanging roof' (CIMAR, 1900: 9). At the Jogta coalmine of Messrs. Agabag Brothers there was a major subsidence in 1907. When the surface collapsed, two children were buried (CIMAR, 1907: 3-12). Such accidents increased with the dramatic expansion of quarries towards the late 1910s and the early 1920s, and again in the first half of the 1940s. On the other hand, the problem of subsidence and eruption of fire in collieries increased in numbers since the late 1910s and especially in the recession years, as the industry began to rely greatly on pillar winning.
III. Employment of Woman Colliers and the Presence of Children in Quarries
IV. Miners Ready to Enter a Colliery Incline and a Crushed Bamboo Helmet

A group of miners wearing bamboo hats ready to proceed underground.

A bamboo hat worn by a miner and damaged by a fall of roof.
**Gases that explode**

The explosion of firedamps and coal dust, eruption of water, and suffocation by natural gases are other geophysical variants of mishap. As the colliery goes deeper, its working faces become distant from the shaft-bottom and other sources of natural or mechanical ventilation. This leads to an accumulation of combustible firedamp and coaldust. The cutting of coal produces inflammable gases (mostly oxides of sulfur), coaldust. In bituminous coal seams, methane gas was produced. The combination of these effluents form combustible firedamp (when methane gas in the air has a concentration between 4 to 16 percents; a concentration of around 10 percent being most inflammable) that hangs in the air especially near the working face and the goaf. On the other hand, combustible coaldust (a finely powdered coal created by the crushing or pulverizing of coal of brittle nature) spreads all over the gallery where cutting, loading, and tramming of coals carried out. The coal dust remains suspended in air and is susceptible to spontaneous combustion. This is so because of the presence of auto-oxidant sulfur and carbon. The latter elements help absorb oxygen and raise the temperature in the surrounding regions, thereby leading to spontaneous combustion and coal fires. Over time, there was an increase in the frequency of these explosions of firedamp and coaldust. In 1935, for instance, three explosions of firedamp and coaldust burnt down eighty-three colliers. A year later, there was a major explosion in Poidih Colliery of Raniganj, but two hundred miners had a miraculous escape.

The collieries never arranged for adequate ventilation instruments, such as ventilators, natural drifts, and bratticing arrangements. These were essential to dissipate the accumulation of firedamp and other poisonous gases when the mines were dug deep. Firedamp (methane gas) is a colorless and odorless natural gas that was difficult to track. Sirdars and over men were expected to inspect underground spaces to ensure safety. In the absence of proper inspection, colliers frequently met with accidents, as their fire lamps exploded and the methane in the air caught fire. It proved fatal in the workplace, where the mining sirdar and overman did not conduct, in accordance with the IMA, 1901, prior examination of the presence of firedamp, and the ventilation was insufficient.
Here is a description by W.H. Pickering (CIM) of one such accident in 1907 at Equitable Coal Company’s Dishergarh colliery (Raniganj):

The place had not been worked for thirteen hours, and the evidence seems to show that it had not been properly examined in the meantime. Deceased was working in a gallery, and although the seam is 13 feet thick, owing to a length of floor coal being left on, his working place was only 5 feet high. ... Owing to the fact that the face of the coal was 28 feet beyond the current of fresh air, there was nothing to remove any accumulation of gas that might occur. Apparently, the first time the deceased had occasion to lift his open lamp near the roof some firedamp exploded and burnt him with fatal results... The officials examine the mine with safety lamps, and it is always difficult to disprove a statement that any particular part of a mine was so examined. 9

After a major explosion in the same mine in 1918, G.F. Adams (CIM) described why such explosions were frequent:

Until shortly before the explosion, No. 3 pit main east level had been stopped off immediately to the east of the main dip. It was, however, decided to win the pillar lying to the rise of the level. With this idea in view, the stopping was broken down, and arrangements were being made for a new “Jig” road to the rise and for ventilating the rise workings. ... In order to conserve all the available air for the ventilation of the new rise district, it was necessary to build a stopping in each of these two galleries and stone stoppings were being built when the explosion occurred, fourteen persons being employed at this work. They all used naked lights... Attention is now drawn to the goaf lying immediately to the dip of these two stoppings. It was proved in evidence that, while some of these persons were up in the goaf, getting stones for the building of the stoppings, gas was ignited at the naked light of one of them ... All fourteen were burnt...with the result, ten of them died ... The explosion occurred at 9 A.M. on Monday morning. The gang building the stoppings commenced this work on the morning of the previous day. It was established that no test for gas in the goaf was made before the work was commenced on Sunday morning and it is more than doubtful that this was visited at all during that day by an official. It is certain that none of the European overman visited the spot. He has affirmed that he tested for gas with a safety lamp. The thoroughness of his test may be gauged by the occurrence of the explosion an hour afterwards. ... Explosions of gas occurred at Dishergarh colliery in 1910, 1915 and 1916. ... After the explosion in 1916, safety lamps were reintroduced throughout the colliery and this system was in force until January 1918, when, at the request of the manger, the agent sanctioned the lighting of the whole of the Sanctoria seam with naked lights. This continued, except in advance drivings where safety lamps were used as a precautionary measure, until the occurrence of the explosion under report. 10
At times, the colliery did not need naked lights to ignite firedamp. The exposed coal seams undergo auto-oxidation (because of the presence of sulfur), and this generates heat leading to autonomous combustion of coal and the consequent outbreak of fire along with or without an explosion. By the end of the second decade of the twentieth century, new initiatives were undertaken to control such accidents. In 1918, for instances, the Sitalpur coalmine of Bengal Coal Company Limited introduced the use of new ventilation facilities and safety lamps. It also regularized the practice of thorough examination of inflammable gases before the commencement of mining, and installed two shaft outlets (CIMAR, 1918: 4-12).

Explosions continued to occur, however. On 23 March 1921, Roni Korah (a twenty-six years young malcutta) lost his life due to the explosion of firedamp in Victoria Coalmine. The company that operated the mine, New Beerbhum Coal Co. Ltd., had not introduced adequate safety measures. It continued with the practice of mining the gallery without ventilation, conducted no regular examination of inflammable gases, and the employed untrained sirdars and overmen.11

Modernization of the mines ironically also created conditions where explosions could occur. The use of modern technologies – gunpowder, explosives, electricity, haulage, and coal-cutting machines – to raise productivity led to problems. They intensified the production of coal dust and created many more sources of sparks that could ignite the explosive gases. Collieries needed to put into place an arrangement for regular sprinkling of water to overcome the problem of increased dryness and dustiness. However, not all collieries arranged for sprinklers. Blasting operations generated coal dust that ignited easily from the flames produced by subsequent use of dynamite. In 1921, for instance, in the Sijua coalmine operated by TISCO, three men were sitting significantly away from the site of blasting operation. They heard the blast, saw clouds of smoke and coal dust, and then watched the flames come and engulf them. The report of the incident stated:

The place of accident was a narrow heading partly in coal and partly in stone which was being driven in the vicinity of a new shaft. The heading was 10 feet wide and 6 feet high. It had been driven to a
distance of 90 feet from the shaft, and in that distance, there were two right angle bends. The stone, which came from the driving, had been packed along the side of the road so that the available width had been reduced from 5 to 3 feet... In the lower portion of the face of the gallery, and within an area, 7 feet long by 2 ¼ feet high, ten holes had been drilled in the coal. These holes were charged with 5lbs. of dynamite, and the charges were subsequently exploded, producing flame, which traversed the two right angle bends and burnt three men who were seated near the shaft at a distance of 90 feet from the face. These men stated that half a minute after the explosion of the shots a thick cloud of dust and smoke came out and was followed by a red flame, which went back, but returned after a few seconds and then went back and died out. The previous blasting, which had been done, had produced a quantity of very fine coal dust, and this had settled in the interstices between the stones packed in the gallery. It seems probable that the first shots which exploded raised a cloud of fine coal dust, and that this was ignited by the flame from other shots, which were probably blown out (CIMAR, 1921: 15).

After the incident, the Chief Inspector of Mines, R.R. Simpson, emphasized that the frequency of powerful blast ought to be regulated: there had to be a time gap between one heavy explosion and another.

**Poison in the gas**

The gases in the mines were not just inflammable. They were poisonous. Coal seams emanate carbon monoxide and carbon dioxide gases and various oxides of nitrogen. Wherever proper ventilation was lacking, these gases accumulate to dangerous levels and sink to the bottom of the deep pits. Trapped within these pits, in the darkness of the underground, miners often watched themselves die. In 1907, Gope, a sinker, went down to one such pit in the Benahir coalmine run by Standard Coal Co. Ltd. Here is a description of what happened that fatal night:

The pit was being sunk from one seam to another, and it had actually penetrated the coal in the lower seam... No one had been down the shaft during the day and a sinker named Gope was lowered at 11 o'clock at night. As soon as he landed at the bottom, his light went out. He shouted up for the lamp to be drawn out and re-lighted: this was done. The sirdar in charge of the gang made several attempts to send a light down, but each time the light went out. It then seemed to have occurred to him to call down the man. He got no answer, but thought he heard him breathing hard, he next came out of the mine and called the manager. The manager soon arrived and sent a light down once more. Although the pit was 34 feet deep, the light extinguished when it descended only 10 feet... Water was thrown
down for about an hour, and then a descent could be made. Of course, the poor man was dead...It is strange that it did not occur to anyone in authority that carbon dioxide gas is formed in mines, especially in badly ventilated mines, and that its specific gravity causes it to flow to the lowest point ... There was an inexcusable loss of life (CIMAR, 1907: 3-12).

W.H. Pickering (CIM) recommended that an official with safety lamp should be the first one to descend when a fresh shift of men was going in. It was never safe to descend an unventilated pit without first trying it with a light; and a sinking pit had to be efficiently ventilated. Subsequently, the mining sirdar learnt to carry a bird in a small cage to detect the presence of the poisonous gases. Birds in cages rather than modern safety lamps came to rescue human beings.

The industrialists soon recognized that mechanical ventilators were indispensable to extract damp gases from the working faces and to pump in supplies of fresh air into suffocating pits. They were critically important in areas with particularly intense accumulation of inflammable, combustible, and poisonous gasses. The actual number of mechanical ventilators installed was never adequate. Therefore, miners continued to die, burnt in fires, asphyxiated by poisonous gases.

**Floods in the mines**

Water frequently flowed out of the walls of coal seams. Installation of water pumps was necessary to make collieries workable. Occasionally the mines were inundated with water that gushed in from outside during the rainy season. The problem was particularly acute in collieries located in low-lying areas near water ponds, or rivers. When the rains came, the river overflowed, breaking the bunds, and flooding the mines. This is what happened in the Ganzlatar Coalmine run by the New Manbhum Coal Co., Jharia, in 1907:

It is only necessary to walk along the outcrops of some of the coal seams near a riverbed to gather what will happen in the rainy season. In this case, three men quite unauthorized went into an incline on a Sunday night to fill dust, as they knew there were empty tubs available. The survivor said it was raining hard and they might as well be in the mine as anywhere. They had worked for some time and
then gone to sleep. They were rudely awakened by feeling water about them and found themselves in
the dark. One man reached the bottom of a shaft and his shouts attracted the attention of the manager,
who had been sent for as the river running close to inclines was rising at a rapid rate. Before the man
was drawn up, the water had risen 9 feet in the pit. He did not know where his companions had gone
to; and they were unfortunately drowned. ... The Katree river runs within some 50 feet of the first
incline, the two being separated by a narrow bund 10 feet high, made of soft earth. As the water in the
river rose, it undermined the bund and also worked around the end of it and rushed down the inclines
(CIMAR, 1907).

Mining Companies used to construct embankments to protect mines from possible flooding. However, bunds could not stop the rainwater from seeping in, making its own passages through the bunds, finding its way through cracks and depressions caused by subsidence due to goafing. Over time, coalfields became dotted with abandoned quarries, pit galleries, and ponds with gallons of water. In most mines, there were no proper surveying and owners often goaded colliers to extend the galleries outward, thinning the coal wall dangerously, and mining close to water reservoirs and rivers. This intensified vulnerability to floods. There was for instance, a disastrous flood in the Loyabad Coalmine, and the Ekra Khas Coalmine in 1948; one in the Central Bhowra Coalmine in 1958; and later again in the Chasnala Colliery in 1975. Many miners died in these mining disasters. After the Loyabad inundation, the Inspectorate set out certain guidelines for the regular training of surveyors in order to instill efficiency, and ensure safety. The management now had to maintain a 12-feet coal barrier to avoid proximity to water sources. However, the subsequent instances of floods showed how the guidelines were vulnerable to the entrepreneurial flouting.
Lift-cages, coal-tubs, and railways

About forty to fifty percent of the total accidents were associated with the handling of mining tools, like lift-cages in the shaft, explosives used for blasting a coal seam, coal-cutting machines, tram lines and tubs, haulage engines, boilers, railway sidings or tramways, lamps, and the electricity. The geophysical character of the mishaps we have discussed until now in many instances is linked to the mechanical character of the colliery. Industrialists install machine tools to undertake vertical and horizontal expansion of mining activity. Since miners handle these tools, and engineers and supervisors have to oversee their use, hazards were linked to both human and mechanical causes.

New technology brought with it new forms of accidents. The lift cage in a shaft was introduced to help miners reach underground workplaces and to lift coal onto the
surface. As a colliery went deeper and undertook pit mining, the significance of the lift cage increased enormously. Accidents associated with the lift-cage also increased in significance. The proportion of these accidents increased continuously at the turn of the 19thc, and slowly dwindled towards the late 1910s. The proportion was about one-fourth to one-third of the total mishaps in 1900, and it fell to about nine percent in 1921. The situation was rather grim ‘particularly when it is considered that comparatively fewer miners are lowered in cages and so much of the coal raising in India is by inclines and not from shafts’, lamented Stonier (CIM) (CIMAR, 1900: 8). These accidents happened due to a variety of reasons: sometimes the lift ropes or chains snapped while ascending or descending, at other times miners fell off the lift, or slipped into the shaft from the surface and were hit by the descending lift. The use of corroded materials increased the possibilities of mishaps.

In their attempt to reach early for work, miners used to crowd the lift. Often this led to fatal consequences. On December 6, 1900, Mahomed Ally, a fifty-year old pump-khalassie, ventured to descend on to the lift with one foot on the hook attached to the rope. He lost his hold and fell to the pit bottom in Seejooah colliery operated by Katras, Jherria, Finlay Muir and Co. There were many such cases of mishaps. Soochand Bowry and Pudian Chamur, both in the early twenties, worked in the Toposi colliery in Raneegunge. Their work was to bail out water from the pits. One day, June 6, 1900, they stepped out of right the lift cage when it was only halfway down the shaft, and fell to the bottom to the pit. Similarly, on April 7, 1900, Lalit Singh, who worked in Jamuria colliery in Raneegunge, fell off the lift while he was going up to the surface. We are not sure why these three workers stepped out of the lift-cage mid-way. One possible reason could be that the lift cages got stuck on the shaft walls, as they sometimes do, oscillated viciously, dropping the workers to their death. There were many twists in such tales of accidents. In one case, at Sitalpore colliery, two young stonecutters, Nara Majee and Budhoo Teli, fell into the deep pit and died on May 8, 1900. The reason: they were stepping into the lift when the engine man by mistake raised the lift-cage over to the pulley, instead lowering it to allow the workers to get in.

Miners also faced certain complication in handling lift-cage at the pit bank. Consider the following reports of accidents. In Seebpore colliery, a tub-man rushed a tub
on to the iron plates at a pit bank; it collided with and broke the closed Iron Gate. The worker fell with the tub to the bottom of the shaft, which was 80 feet deep. In another incident, on 7 April 1900, in Luchipur colliery in Sitarampore, a trolley at the mouth was struck by an ascending cage. A plank flew out of the trolley into the pit, crushing to death two sinkers, Lotoo Singh and Dasoo Roy who were working at the pit-bottom. Two weeks later, in Sodepore colliery in the same area, a twenty-year old stonercutter, Bhatoo Singh, was crushed to death by a stone that fell on him from the side of the shaft.

Learning to operate new technology took time. There was a lag between the time a technology is introduced and the time operators and workers come to master its use. This lag, as I have already referred to, was the cause of many accidents. Clumsy application of the lift-cage gear, for instance, caused innumerable deaths and injuries. In 1918, at TISCO’s Malkera Choitodih coa1mine ‘one man was being lowered in one cage, while another man was being raised in the other. The over-winding occurred, the gear came into action too late, and both men were killed (CIMAR, 1918: 4-12).

The Inspector of Mines admonished Coal Companies for the frequency of accidents and asked them to have weekly tests of all complicated devices like the gear of the cage, so that their alignment and adjustment was perfect. Pickering, the Chief Inspector of Mines, emphasised as early as in 1907, the necessity examining the condition of winding rope at some regular intervals, three or four times a year, and the use of strong ropes specially made for this purpose.
VI. Accident Riddled Shaft in Dishergarh Colliery (1939), and Jharia Khas Colliery (2008)
By the 1920s, the collieries were trying to introduce measures to prevent such accidents. The coal tubs and tramline are fundamental components of underground mining. The big establishments began to install haulage engines and extend tramlines to working faces at the time of WWI. It helped the collier to move with ease, and it speeded up the movement of coal tubs placed underground and on the surface. The mishaps associated with it went up continuously up to the 1940s: the proportion was around eight to ten per cents of the total mishaps in 1900, thirteen percent in 1921 and around fifteen to eighteen percents of the total fatality in the latter 1940s. Thenceforth it came down by about half by the late 1950s. Moreover, it caused many serious injuries that were officially classified as ‘minor’. The coal tub at times ran freely, turned over, and crashed with the operator handling it, or workers present nearby within the colliery gallery. This frequently happened when the rope, the coupling chain, the hooks, or the drawbar broke, and the couplings were detached. Poor maintenance of tramlines often led to accidents: tubs fell on trammers who were busy in hand tramming, and guiding the tubs on curves.
re-railing a de-railed tub, and coupling or uncoupling a set of tubs. Colliers resting or
loitering about haulage roads were frequently crushed between the uncontrolled tubs and
the sides of galleries. On 9 January 1900, in Sodepore colliery, a drawbar broke and the
tub rolled down the incline, over-turned on Dharia Chamar, who was sitting below the
working portion of the line. The fourteen-year old coal-cutter was instantly crushed to
death. About a month later, Lunga Majhin, a thirty-five-year old coal-carrier was fatally
injured on when she stepped in front of four loaded tubs brought along a level road to the
pit-bottom in Chanch colliery in Manbhum. In 1918, in the Malkera coalmine of TISCO,
the following accident occurred:

a miner, who was lying asleep at the foot of an underground haulage plane, was run over by a runway
tub and killed. Inquiry disclosed the fact that the runway was due to the opening out of a \textit{D link}
coupling. This coupling was of an unsuitable character. The pin used to keep the bolt in its place was
not attached to the coupling and there was, therefore, full opportunity for it to be inserted. It could not
be found after the accident. It was also found that the drag was useless. The upper part was too short,
with the result that the prongs hung vertically and were unable to come into action (\textit{CIMAR}, 1918: 4-12).

In Tetulmuri coalmine, a dangerously worn and torn rope kept in use was unable to bear
an increased load of tubs at the time of war pressure:

The rope was originally 7/8-inch diameter and had been at work at various inclines for 3 1/2 years. It
was found on inquiry that it was so worn that the average diameter had been reduced to 1/2 inch. At the
point where it broke, there were only 26 wires instead of the full number of 42. These wires were worn
and brittle. According to the evidence of various persons, the rope had broken for three to six times
during the previous three months, and the working load had been reduced to 3 loaded and 8 empty
tubs. ...On the day before the accident, the manager found a bad place in the rope and by his order the
rope was cut, about 2 feet of it removed and a pair of sockets put on. The break, which caused the
accident, took place a few feet from the sockets. ...The Inspector of Mines, after examining the rope,
gave it as his opinion that it was in such a bad condition that it should not have been used, or, if it was
used, the load should have been not more than one loaded and three empty tubs (\textit{CIMAR}, 1918: 4-12).

The hazardous encounters with coal tubs, owing primarily to shabby maintenance of
tools, continued to kill and injure workers.
For the mining society, the experience of *railways on the surface* was similar to that of the tramway underground. The industry deployed the railways to serve the sphere of circulation. For colliers the space around the railway lines became another zone of risk, a place where accidents could happen. A railway wagon ran over Ramlal Mumaza, a
twenty years young wagon loader, on January 26, 1900. Ramlal was at the time shunting the wagon in the siding in Kustore Colliery.

**Explosions in the caves**

Four varieties of explosives help enhance the productivity of mining operations. These are gunpowder, high explosives, permitted explosives, and liquid oxygen. The driller prepares holes in the coal seams and inserts cartridges of particular explosives. The mining sirdar or shot firer detonates the cartridges. The miss-calculated use or abuse of explosives can lead to disproportionate blasting and accidents. Sometimes driller inserts the cartridges in irregular manner, delaying the blast of these. The use of explosive can, therefore cause accidents in both the direct and indirect ways.

Handling of explosives caused about two to five percents of the total fatalities in the first decade of the twentieth century. The proportion rose to seven to nine percent from the time of WWI. On April 19, 1900, in Luchipur Colliery, six charges of dynamite were fired with hand at 6 a.m. After the sirdar’s examination, eight men were asked to clear the debris and drill side-holes. While they were clearing the place, one of the unignited charges exploded. Two sinkers, Khayo Gope and Mitan Gope, were
instantly killed and two other sinkers, Hiraman Telly and Khiro Korin received serious injury.

Miners gradually learnt that the utilization of an electric shot-fire and use of the appropriate explosive for each type of coal seam could help reduce accidents. The very process of preparation of cartridges from loose explosive powder sometimes led to casualties. In Banksimula Colliery (BCCL) in 1918:

three persons were fatally burnt by an explosion of gunpowder. It was the practice at this colliery for the shotfirers to be supplied by the powder manufacturer with loose powder, which they themselves made into cartridges in or about their houses ... The deceased persons were evidently manufacturing cartridges within a hut in which a fire was burning. The powder became ignited, exploded and burnt them with fatal results... Accidents of this kind are frequent and it is to be regretted that more careful supervision of the manufacture of gunpowder into cartridges is not exercised (CIMAR, 1918).

Adams, the Chief Commissioner of Mines, recommended now that ‘no loose powder is to be issued to miners or shot-firers for the purpose of making cartridges. The powder manufacturer is to supply the cartridges ready for use in the mine, and no cartridges are to be taken to, or stored in, any dwellings on the colliery. The management should maintain a separate explosive room, and employ explosive carrier, and trained mining sirdar to undertake shot firing.’ Subsequent legislation asked the industry to employ a separate class of shot-firers in order to allow the mining sirdar to concentrate on other safety supervision.

As we have already seen, explosives often ignited coal dust found in galleries. This became a major problem since mining industrialists increasingly depended on explosives, instead of costly coal-cutting machines, to raise productivity and reduce the cost of production. Following a set of disasters, D. Penmen (CIM) recommended that (i) No gunpowder and high explosive shall be fired in underground mining, given the possibility of their mishandling in the processes of preparation and use. (ii.) Only British explosives from the “Permitted” list ought to be used. (iii.) A shot firer shall not fire a shot until he has examined both the places itself and all contiguous accessible places within the radius of 60 feet for the presence of inflammable gas and has found such place free from gas. (iv.) No shot shall be fired until the place itself and all contiguous
accessible places within a radius of 60 feet have been drenched with water to such an extent that there will be no danger of dry coal dust being raised into the air by the shot. (v.) He further suggested that ‘a large measure of safety can be attained by the firing of shots between shifts.’ Mining industrialists were aware of these ideas but never followed them. The mining regulations of 1938-39 entered these recommendations in the mining statute book.

The dangerous lamps

The miners relied on the use of kuppi-batees (lamps using vegetable oil) and lanterns to illumine underground galleries, like their houses at night. Kupee-batees and lanterns held significance in a period when the industry was already aware of its danger. From the early nineteenth century, it was also aware of the [Davy] safety lamp with flames. By the late nineteenth century, modern electric safety lamps had become common, and by the 1930s, there were battery-powered helmets. The fire from the open lamps frequently ignited the inflammable gases in the mines. Stonier (CIM) noted the following incident in 1900: ‘there was one slight explosion of firedamp, but it was not attended with fatal results. ...but when a man entered with a naked light an explosion occurred.’ Such reports recurred.

Following the recommendations of the inspectorate (Pickering, 1908) the big collieries began to install electricity from the mid-1910s to support new mechanical machines and purchased a few safety lamps of flame type to test the presence of methane and carbon monoxide gases (Chapter, ‘Working’). The miners found the lights from flame-type safety lamp inadequate and tampered with its glass. Tampered safety lamps and open acetylene (a chemical compound used as fuel in flame-type safety lamps) in general continued to cause frequent explosions of firedamp. In the Adjai second colliery, the explosion of firedamp ignited by the open acetylene lamp carried by a group of workers and engineers burnt them to death 4 persons on July 14, 1936. They had gone to inspect the colliery, reopened after a break of six years. Thirty-five mining workers lost their life in Loyabad colliery in Jharia on January 30, 1936. The report stated that it was due to an explosion generated by ‘either a spontaneous combustion or some accident,
such as the upsetting of a lamp or spilling of oil'. Thenceforth, the industry saw the need to use non-flame type safety lamps. The Mines Department asked all the firms in 1958-59 to replace lanterns with safety lamps.

With electricity came the problem of electrocution. Bad wiring, inadequate earthing, unprotected live wires, leakages were common in the mines. After one accident at Malkera-Choiotdh Colliery in 1918, the Chief Inspector of Mines reported:

The current was supplied at 220 volts, by a lead covered cable, carried by a pair of galvanized wire ropes, suspended from planking on the surface. The man who was killed touched the cable accidentally, fell across it, and remained there until removed...On the morning of the accident, the electrician fitted the shaft bottom with some lights and then reported to the manager that there was a slight leakage of current. The manager told him to cut out the defective part of the cable and he reported about half an hour later that he had done so. The manager then went down the shaft and, on examining the cable, felt a slight shock and stationed a man to keep persons away from the cable. He has stated that he then told the electrician to replace the defective cable at once. The latter has denied that he was told to do this at once and has stated that he meant to do it in the afternoon. ...The accident was due to the inefficient earthing of the cable sheathing or of the wire supporting ropes, to which the cable was tied at frequent intervals by metal wire (CIMAR, 1918).

Mattoo Khan, a thirty-five-year old coal-cutting machine mistry, and Taro But, a thirty-year old labourer, lost their lives when they were electrocuted in an electric coal-cutting machine. The incident happened on October 25, 1921 in the Katras Jharia Coal Company Limited's Seebpore mine (CIMAR, 1921: 69). A more shocking accident occurred on December 18, 1936 when two hundred and nine colliers were entombed at the Poidih Coalmine. These colliers were killed by a series of explosions of firedamp that had accumulated in some goaf. The Court of Inquiry identified some five factors responsible for the ignition of firedamp: '(a) A defect in or accidental damage to a safety lamp. (b) Misuse of a safety lamp in the presence of gas. (c) A light from a match or other apparatus for producing a light. (d) A spark from electrical apparatus. (e) A spark from some other accidental cause, e.g., a falling stone in a goaf, or a runway tub.' The enquiry highlighted two factors that created conditions for the accumulation of inflammable gas: neglect of the atmospheric condition in goaf areas and, the asence of ventilators to clear the gases (CIMAR, 1936: 22-30).
X. A Coal-cutter at Rest with a Kerosene-oil Lantern, and Hoe-tool nearby Debris of Coal-pieces (1950s).
XI. Davy Safety Lamp and its Use in the Jharia Mines to Test the Presence of Poisonous Gasses

![Image of Davy Safety Lamp]

Text:

"Left Lamps are used to test for gas. If the lamp ignites lamps encased in a wire, it indicates the presence of gas by the lack of light, such as this caused serious accidents."
Davy’s safety lamp not meant for illumination in the darkness but is used as indicator of the presence of poisonous gas.

By courtesy of E.C.L.
XII. A Statue, Erected in Dhanbad, of a Collier Standing Straightened and Equipped with Shovel, Basket, Torch-Cap-lamp, Basket, and A Pair of Boots (2008)
प्रथम राष्ट्रीय स्वानिक प्रतिमा सूरजन्म्य भारत कोकिंग कोहल लि.
Our discussion upto this point has suggested an intimate connection between the geophysical and the mechanical aspects of mishaps. The use of coal-cutting machines, explosives, and underground haulage system raised the level of combustible coal dust that could ignite and explode. When accumulated coal dust caught fire, or exploded, a minor mishap could turn into a disaster. In the Bagdigi Coalmine in Jharia, on June 29, 1935, nineteen colliers were entombed; sixty-two colliers died on July 24, 1935 in Jokitabad Colliery; two-hundred-nine persons were entombed in Poidih Colliery in 1935, and 176 colliers were burnt in Chinakuri Colliery on February 19, 1958. The combined operation of geophysical and the mechanical factors could cause havoc in the mines.\textsuperscript{19}

**Persons at faults**

Let me now discuss accidents related to the working of *human constitution*.\textsuperscript{20} We can identify two varieties of accidents, some incidental, others recurring. In the early years of the industry, colliers were unused to machines, and lack of familiarity with mechanical operations created problem. At times, they misjudged the dangers that confronted them in their work environment. In the Narsamuda coalmine, two child-workers, one boy and one girl, employed to bail water died in 1907. The Chief Commissioner of Mines, Pickering reported: ‘It appears that they were idling, and hearing the sirdar coming and were anxious to get out of his way; when they passed the pump and a bamboo fence and unfortunately fell into the hot water.’ As we have seen, resting and dozing, common in a situation where work was strenuous and hours were long; and this made colliers vulnerable to accidents. Sanki Meah, a twenty-five-year-old *malcutta*, Anwari Meah, a sixteen-year-old *malacutta*, and Pama, a fifteen-year-old coal-carrier, lost their lives on May 10, 1921, in Alkusa South Coalmine, managed by Raneegunge Coal Association Ltd., (\textit{CIMAR}, 1921: 12). All three were asleep when 14 tons of coal fell from the walls, crushing them to death. Following this incidence, Simpson (CIM) emphasized the need to institute a regular shift system to ensure a greater attentiveness on the part of miners and vigilance on the part of officials.

Over time, miners learnt how to handle new machines. Slowly they accumulated experience through work. Through training and disciplinary institutions, they were
socialized into the new work environment, and internalized many of the new principles of mining. In a sense the human essence of miners, their very human constitution was reconstituted through this process. They could assess what machines made possible and the dangers they posed. Therefore, in the contemporary parlance, the experts heading the enquiring committee as well as the common miners frequently referred to the new variety of mishaps as 'preventable' or 'avoidable'. Errors of judgment (i.e., the deficiency and limit of the wisdom held) or the defiance of the wisdom were seen as the causes of many of the mishaps. The Inspectorate began, since 1912, classifying the social sources of accident around five categories: the Misadventure; the fault of the Deceased, of the Fellow collier, of the Subordinate staff, and of the Management; and the Faulty Materials.

Following the above official classification, with all its problems, we find the category 'misadventure' constituting the highest percentage of total fatal accidents. It
increases its share in two phases, from the late 1910s and then in the late 1940s. Next in importance is the category ‘the fault of the deceased’. An inverse relationship between the categories of accidents classed as ‘misadventure’ and the other categories.

**Conclusion: problematising the notion of responsibility**

The combined scientific effect in the fields is such that spawns a baffling and befuddling relationship between ‘vulnerable’ direct producers and scientist/surveyor/ university-researcher. When I began interviewing miners, they were often reluctant to talk. They said:

> What was the use of this interview? There have been many such interviews by government officials as well researchers. Grudgingly we told them our stories. We told them that we had no proper medical facility, no health centre, and no support for house repair. The kamins were called upon to perform many tasks (like carrying coal to the houses of mining staff and acting as peons in the offices) which did not constitute their duty. They were subjected to male abuses and flirtations. Researchers have come and gone. Our lives have not changed.

The concern of the miners was, at one level, different from mine. They were raising questions pertaining to their lives. Their complaint revealed an effort to know the truth of practice, and pointed to the failure of officials to, productively, respond the miners’ wisdom, their knowledge about the problems of their lives.

The focus of this chapter has been on gaps – the gap between technology and the knowledge about technology; between, problems in handling machines and steps taken to overcome the problems; between miners’ awareness and wisdom, and capitals effort to understand the truth of that wisdom. Louis Althusser has emphasized that the study of what is unsaid in a text is as important as what is said. What I have argued in this chapter is that we cannot understand the problem of accidents simply through the theory of lags that Virilio (2008) has formulated. We need to see that there was also an insufficient political will to conceptualize the question of safety. The theory of lags/gaps taken to its limits does not enable us to fix responsibility. In the politics of the mines, this idea of responsibility cannot be avoided. However, a serious exploration of the lags does allow
us to understand what human constitution, human wisdom, could not avoid, and what it could. In this sense, it allows us to problematize the idea of responsibility.

1 The Inspectorate of Mines catalogues accidents in its annual reports under four headings on the basis of the place rather than the source of accident: Underground Accident – Falls of Ground, Shaft accident, and Miscellaneous underground, and Surface Accidents. In addition, it creates several subheadings based on factors responsible for the accident.

2 Notably, the assumption that the social labour-power of the working person is a commodity and factor of production and not a productive force or social force is a bourgeois notion.

3 The trend of mining accidents discussed below is, of course, representative of all the coal mines in India. The Jharia coalfield was a nascent one at the turn of the nineteenth century. There were other coal fields — like Raniganj and Girdih — which had opened earlier. However, the Jharia coalfields developed faster towards the second decade of the 20thc, when it alone registered about half of the total coal output in British occupied Indian subcontinent.

4 CIMAR, 1907: 3-12. Pickering (CIM) prescribed that if the roof had to be taken down, it would be much safer to do so before the floor coal was dug up. The miners would then have something firm to stand upon and could more easily see what they were doing. Addressing this problem, around 1938-39, the Inspectorate introduced the provisions to regulate the width and the height of galleries and the pace of mining.

5 CIMAR, 1918: 4-12. The IMA, 1901, emphasised the need for fences to stave off ‘ignorant’ collier from succumbing to the dangerous accidents. The current case shows how the fault of the management in charge of work organisation caused the death of the miner.

6 The mining regulation (1936-37) stipulated that a gallery of not more than 16 feet wide and 10 feet high was necessary to ensure sufficiently sustainable propping arrangement.

7 Faced with disastrous outcome of pillar winning in unsound manner, G.F. Adams (CIM) suggested in 1919: ‘The cutting of a pillar alongside under the roof, and the undercutting are not safe operation. It is much better to derive a narrow road, just under the roof, right through the middle of the pillar. This road forms a platform, from which the subsequent operations may be undertaken.’ (CIMAR, 1918)

8 This hints at the phenomenon of increasing concentration, towards the late 1920s, of women’s solidarity at the surface and in the quarry.

9 CIMAR, 1907: 3-12. The Mines Inspector, investigating the accident, pointed out with the aim to improve the working of safety staffs that the mining sirdar should be compelled to leave some mark in each working place, which will show that they have actually visited it. He admonished the management to concentrate on the installation of ventilators and proper brattice, use of safety lamp of flame type, putting checks on the tampering of safety lamp, need of the proper examination of mines by mining sirdar in order to put a check on explosions. Notably, the uses of lamp’s naked lights or tempered safety lamp continued even when the Debby’s safety lamp was well known.

10 CIMAR, 1918: 4-12. The entire episode represents a classic case of the miscarriage of application of known safety wisdom, a worst kind of pleasure in working with the disregard for any basic necessary of sound mining culture. The case alluded to a number of elements of the mining practice, which we will take up one by one in this essay.

11 CIMAR, 1921: 8, 9 & 45. Following such accident, especially that of the Amlabad Colliery (Jharia, Eastern Coal Co. Ltd.), R.R. Simpson (CIM) issued instructions that no naked-lights were to be allowed in a gassy mine, and that ventilation facility had to be extended upon the expansion of galleries.

12 The abandoned colliery was liable to establish some incidental connection with a running colliery only because of the flouting of the safety guideline.

13 There are three types of collieries: the quarry, the incline and the pit or shaft-mine. Lift-cage is essential only in shaft mines.

14 This points out increased concentration, towards the late 1920s, of woman in surface and the quarry works.

15 Since the 1950s-60s, trucks and railways were used together to transport coal.
The shift toward safety lamps and electricity from the mid 1910s was hesitant. Industrialists dithered and debated, while explosions in the mines continued. We can regard the history of this shift as one of the promising developments in coal industry. The slow introduction of the safety lamps, however, is a reminder that industrial capital seeks for ever to earn its profits on the basis of low levels of investment in technology, and a sheer disregard for humanity.

The court of inquiry recommended: (i.) A need of improving the mining arrangement in order to prevent accumulation of gases in goaf cavities. (ii) Attention towards the necessity of keeping mechanical ventilators working continuously in order to safeguard against any unforeseen accumulation of inflammable gas. (iii.) To bring to the notice of the Mines Inspector any prolonged stoppage of such ventilators. (iv.) Need to introduce a regulation making it compulsory that persons entering a gassy mine should be searched. (v.) Need to maintain register to show all appointments or authorisations of competent persons. (vi.) To appoint a competent person to examine all the safety lamps in use at the mine at least once a week. The electric safety lamps are less liable to misuse in the hands of irresponsible persons, and their use by all persons except the supervising and inspecting staffs should be encouraged in preference to the flame type of lamp. (vii.) The monthly measurement of air should be made. Yet, a regulation should be issued requiring old workings in gassy mines to be examined once in a week by a competent person. Some arrangement should be made to ascertain the atmospheric condition in a goaf behind the stoppings erected to separate goaf in the mine. (viii.) Need to implement in a more stringent manner the rule related to the treatment of coaldust.

This stands as an emblem of the emergence of the modern miner within a nationalized system of production since the 1970s.

Our overall survey of the geophysical and the mechanical aspects of hazards suggest that four elements held paramount significance: timbering, lighting, ventilation, and surveying.

Human constitution means the interplay of human nature, cultural/ideological predisposition, and transformative social and political capability.

Sources: CIMAR. A marked shift took place since the late 1910s in the classification. The notion of faults on the part of mining personnel showed in some sense defiance of or non-conformity to, or the failure to practice, the rules, and regulations based on the mining wisdom set out since 1901-07. On the other hand, the notion of misadventure alluded to a wide range of behaviours and acts of colliers—'misjudgment' and 'obscure' circumstances liable for mishaps.