

# *A culture of denial: sociological similarities between the Moura and Gretley mine disasters*

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This article concerns two Australian mine disasters which are superficially quite different. One involved an explosion (Moura) and the other an inrush of water (Gretley). However, sociological analysis reveals some striking similarities in the underlying causes. In particular, in both cases there was a culture of denial – a series of beliefs which led management to discount the possibility of disaster and to dismiss the warning signs of danger. The article discusses the significance of this similarity and draws policy inferences.

## **KEYWORDS**

- MINING INDUSTRY
- DISASTERS
- CAUSES OF ACCIDENTS
- MANAGEMENT

## Introduction

Every disaster involves a unique set of events. It does not follow that every disaster requires a unique explanation. Sociological analyses have shown that certain phenomena underlie all disasters. Turner<sup>1</sup> demonstrates that misinformation always plays a crucial role; Reason<sup>2</sup> shows that all disasters involve both active failures, that is, immediate causes, and latent failures, that is, underlying system inadequacies; yet other analysts argue that all disasters can be traced to management system failure.<sup>3</sup> These are very general ideas and it is perhaps not surprising that at this level of generality disasters will be found to have common causes. However, it would be more striking if disasters could be shown to have *particular* causes in common. This article takes two recent Australian coal mine tragedies and shows how, at a quite detailed level of analysis, they have remarkably similar causes. The similarity is especially remarkable in view of the fact that the disasters themselves were quite dissimilar. One involved a methane gas explosion in the central Queensland mine of Moura in 1994. Eleven men were killed. The other occurred when miners inadvertently broke through into an old abandoned mine which was full of water at Gretley near Newcastle in New South Wales in 1996. Four men were drowned as the water rushed in.

## Management failure

It is worth noting initially that in both cases official inquiries blamed the disasters on management failure. Thus, the Moura inquiry panel concluded:

"It is the opinion of the Inquiry that events at Moura surrounding assumptions as to the state of knowledge of the night shift on 7 August and the safety of those at the mine represent a passage of management neglect and non-decision which must never be

repeated in the coal mining industry. Mineworkers place their trust in management and have the right to expect management to take responsible decisions in respect to their safety. They also have the right to expect management to keep them informed on any matter likely to affect their safety and welfare."<sup>4</sup>

Again, at Gretley:

"The evidence before the Inquiry has demonstrated serious shortcomings in the performance of the Department... and... the mining company... In the case of the mining company, the shortcomings were widespread. They affected every level of management, namely successive mine managers, mine surveyors and certain undermanagers."<sup>5</sup>

These are significant findings. Previous inquiries have sometimes blamed the hostile underground environment and the inherently dangerous nature of mining. But both of these inquiries took the view that it had been well within the power of management to prevent disaster and management had simply failed to do what it ought to have done. Management at Gretley apparently exhibited the very same "neglect" which the Moura inquiry had said should never be repeated in the coal industry.

Here then is a fundamental similarity between the two disasters — both were caused by management shortcomings. But it is in the detail of these shortcomings that the remarkable similarities emerge. Consider now this finer level of detail.

## The belief that it can't happen here

A contributing factor common to both disasters was that mine management mistakenly believed that the mine was protected from the hazard in question and that therefore "it can't happen here".

Consider, first, the Moura explosion.<sup>6</sup> Coal exposed to air has a tendency to heat up slowly, in a process known as spontaneous combustion. If the coal is not well ventilated, the process can proceed until the temperature reaches the ignition point of methane. If at any time thereafter the concentration of methane builds up, it will explode. This is exactly what happened at Moura. However, it was believed at Moura that it took at least six months for spontaneous combustion to develop after mining in a particular area had begun. This was known as the incubation period. It was presumed that if mining were completed within this incubation period and the area sealed off, there was little likelihood of spontaneous combustion developing. Mining was planned on this basis. This belief about an incubation period was quite widespread in the industry but, according to the official inquiry into the explosion, it was without foundation. It had been spread by word of mouth and was unsupported by any evidence. It was in fact a mistaken belief — the Moura explosion occurred within the presumed incubation period. Unfortunately, the incubation theory contributed significantly to management's view that the mine was protected from the possibility of an explosion caused by spontaneous combustion.

At Gretley it was known that mining was occurring in the vicinity of old abandoned workings which had been flooded. Management had obtained maps of the location of the old workings from a government department and planned to mine at a safe distance. However, because of a drafting error made by the department, the maps were inaccurate. Mine management did not verify the accuracy of the maps, as the official inquiry found it had a responsibility to do, but simply accepted the plans at face value. Management thus mistakenly believed that they were mining 100 m further away from the old workings than in fact they were. This mistaken belief in the accuracy of the maps contributed significantly to management's view that it was protected from

the possibility of inundation.

Managers at both mines were well aware of the hazards and believed that they had taken steps which would protect them from the hazard concerned. In both cases they accepted the validity of information acquired from others without any attempt to verify its accuracy, even though the safety of their operation depended critically on this information. In both cases any attempt to verify the information would have quickly revealed it to be mistaken or without foundation. The Gretley inquiry was particularly critical of the company's failures in this respect.

## Warnings ignored

A second common factor was that in both cases there were several warning signs of danger that were dismissed or ignored. Most interestingly, the rationalisations for ignoring these signs at Moura were essentially the same as those at Gretley. These rationalisations involved the normalisation of evidence, the use of ad hoc criteria and the idea that signs which are only intermittent in nature can be discounted. These are discussed in what follows.

## Normalising the evidence

Spontaneous combustion gives off carbon monoxide (CO), and the greater the rate of CO production, the greater the cause for concern. The rule of thumb in the industry at the time was that a CO production rate of 10 L/min "requires investigation", while a rate of 20 L/min indicates that "considerable danger exists". Yet, although the rate of CO production was well above 10 for some weeks prior to the explosion, no investigation was undertaken. How could this warning sign have been so blatantly ignored?

The explanation provided by mine management was that a new method of mining was being used at Moura which left considerable amounts

of loose coal in the mined out area. Loose coal gives off more CO, in the normal course of events. As mining progressed, the quantity of loose coal left behind increased and the belief was that the rate of CO production could be expected to rise slowly and continuously. It was presumed, without good reason, that readings above the 10 L/min threshold were to be expected as a matter of course. The logic of this argument was that the first threshold could be ignored with impunity; it rationalised or "normalised" the high readings which were being obtained.

This process by which adverse events are normalised has been noted before as an important precursor to disaster. Vaughan describes it in her discussion of the space shuttle, Challenger, which caught fire and plunged to earth in 1986, killing the seven astronauts on board.<sup>7</sup> The integrity of the rockets depended on certain rubber seals, known as O-rings. It had been discovered on several previous launches that they did not perform as required at low temperatures. In fact, they malfunctioned. Nevertheless, they had not failed totally. Over time the malfunctioning was reconceptualised as normal and the risk of total failure came to be judged acceptably low. (Vaughan describes this as the "normalisation of deviance".) The temperature on launch day was colder than at previous launches. But the technical malfunction had been normalised. The launch was thus given the go-ahead. This time the seals failed totally, with catastrophic results.

A similar normalisation of the warning signs occurred at Gretley. Some two weeks prior to the explosion, officials had observed an accumulation of water in the mine and a deputy (essentially a shift safety officer) twice noted the build-up in his end-of-shift reports. The deputy explicitly raised the question of whether they were getting close to the old workings at this time.<sup>8</sup> Again, just one day before the disaster, the deputy noted in his end-of-shift report that the "coal seam is giving out a considerable amount

of water seepage", a clear indication that he was concerned.<sup>9</sup>

The "best practice" view is that "any water inflow in the vicinity of abandoned mines... should be considered a danger signal".<sup>10</sup> But the response by mine management to the reports of water was that, because they were heading towards old workings, it was reasonable to expect the seam to be saturated with water.<sup>11</sup> Moreover, the mine manager expressed the view that Gretley was a "wet mine" and that the water which was reported was not unusual.<sup>12</sup> In short, even though the deputy clearly regarded these signs as a matter which warranted attention, management effectively dismissed them. The warning signs had been reinterpreted as nothing out of the ordinary and the deputy's observations had been "normalised".

## Ad hoc criteria

A further strategy for dismissing warnings, evident at both Moura and Gretley, was arbitrarily to raise the threshold of what would count as a danger signal, and then to argue that the observed signs had not crossed this threshold. At Moura a view prevailed that a slow and steady rise in the rate of CO production was normal; what *would* have concerned management was a sudden or "exponential" rise. This would be an unmistakable indicator of a spontaneous combustion. Thus, for instance, the manager noted at the inquiry that he was unconcerned when the CO figure crossed the 10 L/min threshold because there was no "sustained steep upward trend".

The thinking here was totally confused. It was widely known that previous spontaneous combustions had been accompanied by an "exponential" rise in CO. But the problem is that, once such a rise occurs, it is already too late to control the situation. An exponential rise is not a warning of potential danger; it is an indicator that a fire is already raging. Tragically,

reliance on the exponential rise theory resulted in a systematic tendency to dismiss early warning signs.

At Gretley, similar "ad hocary" was in evidence. The day before the inrush, the deputy observed water coming out of the face in a stream approximately one inch wide. In his end-of-shift report he wrote that there was a "considerable amount of water seepage". His use of the word "considerable" implied that in the deputy's mind the flow was a matter of concern. Questioned at the end of the shift by his superior, he described the flow as a trickle. His superior then commented that it seemed the water was merely "seeping out", "not squirting out of the face like water pistols".<sup>13</sup> He dismissed the report on this basis. This man had implicitly defined a new test for danger: water squirting out of the face under high pressure is an indication of danger; a trickle is not. No justification was provided for this new test.

The common feature of both of these accounts is that a higher threshold criterion is defined for what constitutes danger. Since the higher threshold has not been crossed, the warning signs can be dismissed.

## **The tendency to dismiss intermittent warnings**

Many warning signs are intermittent in nature. At both mines this seemed to provide a justification for ignoring them.

Some three weeks before the explosion at Moura, a deputy measured a CO production rate of 19 L/min. Remember that, according to the rule of thumb, 20 L/min indicated "considerable danger". A party of officials therefore went down to the point at which the reading had been obtained but was unable to replicate it. The officials speculated that the deputy might have misread the instrument, or that it had malfunctioned, or even that the reading might have been influenced by the CO emissions of a diesel vehicle passing at the time. In short, they

presumed that the deputy had made an error and dismissed his reading.

There were several other instances of this kind of thinking. Coal which is undergoing spontaneous combustion gives off not only CO but also a distinctive smell, sometimes referred to as a tarry or benzene smell. On two occasions deputies noted such a smell and recorded it in their end-of-shift reports. More senior officials who then went underground to check on the smells did not detect them and assumed that those making the original reports had been mistaken. The presumption on one occasion was that the deputy had mistaken the smell of grease drums in the area for the smell of burning coal. On the other occasion it was assumed that the deputy had actually been smelling certain chemicals used underground. The deputies concerned were not told that their reports had been dismissed in this way and were never given the opportunity to rebut the presumption of error. Both in fact were quite certain of what they had smelt and would have been indignant at the response to their reports, had they known.

At Gretley, the intermittent nature of the warnings also contributed to a false sense of security. As mentioned earlier, some two weeks before the inrush it was noticed that water was accumulating at the end of a partially-dug cross tunnel. Shortly afterwards, this dead end was connected to another tunnel and the water drained away to another part of the mine.<sup>14</sup> Of course, water ceased to accumulate there and the warning was lost and gone. No further inquiry was made as to its origin.

Again, the trickle of water from the face on the day prior to the inrush was only observable when the area was undisturbed; when coal was being cut and loaded no water could be seen. This appeared to alleviate whatever concerns there might have been in the minds of the miners themselves.<sup>15</sup>

One difference between the way the two mines dismissed intermittent signs has emerged. At

Moura, management consciously concluded that the deputies had been in error and went so far as to provide explanations for how they might have made their presumed mistakes; at Gretley, it was more a case of out-of-sight-out-of-mind. But, whatever the thought processes involved, it is clear that where warning signs are intermittent in nature they are particularly likely to be dismissed.

## **Management reluctance to withdraw men from danger**

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A final striking similarity between the two disasters was that when management did eventually get an inkling of danger and began to take certain precautions, it did not draw the obvious conclusion that the most vital precautionary measure was to withdraw the workforce until such time as the danger had been thoroughly investigated or had passed.

The day before the explosion at Moura, management began to suspect that a spontaneous combustion was under way. Mining in the area where this was occurring had just been completed and the area would have been sealed off in the normal course of events. But the timing of the sealing was brought forward, as a "precautionary measure". Once the section had been sealed, the concentration of methane in the section could be expected to rise and pass through the "explosive range". All going well, after a couple of days the methane concentration would reach a point where there was not enough oxygen to sustain a fire. After that the mine was safe. But if there was smouldering coal present while the atmosphere was explosive, an explosion was virtually inevitable. Despite the obvious danger, men were sent underground, to their death.

To advance the sealing as a precautionary measure and yet not take the additional precautionary measure of withdrawing the men from the mine at the time of greatest danger

defies commonsense. Management could not explain at the inquiry how it could both suspect that the mine was in danger and yet not give orders to withdraw the men until the danger had passed.

A very similar sequence of events occurred at Gretley. Following the build-up of water which occurred two weeks prior to the inrush, a manager decided that miners should begin drilling into the face where they were working to check that there was solid coal ahead, in his words, "to prove the ground ahead". The purpose was to ensure that the mine did not, again in his words, "run into any surprises".<sup>16</sup> The program of drilling ahead was scheduled to commence a week or two later and had not begun at the time of the inrush.

The decision to drill ahead suggests that the build-up of water had indeed raised doubts in management's mind as to whether the old workings were closer than the plan suggested. But once such doubts had been raised, a program of drilling ahead should have been commenced immediately; the only coherent response to the possibility that the old workings were closer than had been presumed was to cease mining until the ground ahead could be proved. Management's inability to draw this commonsense conclusion defies any rational understanding.

At both Moura and Gretley, management's "precautionary measures" implied a recognition of imminent danger, yet the failure to withdraw men from this danger reveals a simultaneous state of denial. This problem of denial is now discussed.

## **The tendency to discount unwanted evidence: the culture of denial**

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One of the findings from psychological research is that "new evidence appears reliable and informative if it is consistent with one's initial

beliefs; contrary evidence tends to be dismissed as unreliable, erroneous or unrepresentative".<sup>17</sup> Psychology teaches us that where evidence conflicts with belief, the individual is in a state of "cognitive dissonance", an unpleasant state which must be resolved by adjusting either the belief or the evidence. Where the belief is strong, it is the evidence which is adjusted.

A famous example of cognitive dissonance and the reaction to it is the case of a sect in the United States which believed that on a certain day there would be an enormous flood and only true believers would be saved — by a flying saucer which would pick them up. The day came and went without either the flood or the flying saucer arriving. The sect leader then announced that the world had been saved at the last minute as a reward to the faithful. In this way, the evidence which appeared to disprove the sect's beliefs was adjusted so that the beliefs remained unchallenged.<sup>18</sup>

At both Moura and Gretley it was believed that there was no immediate danger. Had this belief been effectively challenged it would have entailed the disruption of production. Given the production pressures under which all mines operate, this is clearly a situation in which we would expect to find a strong tendency to dismiss any contrary evidence. And this is precisely what the inquiries uncovered. Both mines exhibited what can only be described as a *culture of denial*, that is, a set of beliefs which enabled management to deny that there was any immediate danger, no matter what the evidence. To avoid misunderstanding it should be stressed that this culture of denial is an aspect of *management* culture, not the culture of the workforce, although of course miners may be caught up in this way of thinking to varying degrees.

## What is to be done?

This is not the place for a detailed discussion of the management of major hazards,<sup>19</sup> but the

preceding analysis invites some commentary on what might be done to overcome the problem.

For a start, it should be recognised that there is not much point in trying to change the various beliefs which make up the culture of denial. Even though some might be corrected or changed, others would very likely develop in their place. Given that evidence of danger is so unwelcome, such beliefs are almost inevitable.

The way around this problem is to limit the discretion exercised by decision-makers. Putting the point more positively, decision-making must be structured by introducing imperatives to action in certain circumstances which rule out the option of doing nothing. It is only if companies develop policies to guide their managers in these matters, and of course enforce these policies, that the inherent tendencies towards the denial of danger can be overcome.

The first step is for companies to identify what, if any, major hazards they confront. In any given industry it is likely that there will be only a small number of such hazards. In coal mining, for instance, the list would include spontaneous combustion (and more generally, explosion), inundation and roof collapse. Managements must then draw up a plan for the management of each such hazard. These plans must involve a careful analysis of how the danger might arise and, in particular, how they should deal with the possibility that crucial information on which the safety of the enterprise depends may be incorrect. Plans must also identify warning signs which will be treated as triggers to action. They will need to specify to some extent just what kind of actions are mandatory when warning signs are observed and who is responsible for taking the action. Furthermore, when officials decide to do nothing in response to agreed warning signs, they should be required to put their decisions in writing, along with reasons. This would provide a built-in bias towards taking

action, counteracting to some degree the bias towards inaction inherent in the culture of denial.

## Final reflections

The Gretley and Moura disasters are, on the face of it, quite different. One involved an explosion, and the other an inrush of water. Yet a sociological analysis reveals some remarkable similarities.

In both cases there were warning signs which were not effectively responded to. Studies across a range of disasters show that there are always such early warning signs — “discrepant events” — occurring in the lead up to disaster, sometimes months in advance.<sup>20</sup> These events develop and accumulate unnoticed or not understood. It is not surprising, therefore, that such failures were evident here.

Perhaps more interestingly, and this is something which other disaster studies have not stressed, in both cases there was an elaborate culture of denial, a whole series of beliefs which had the effect of nullifying the early warning signs. The two cultures of denial were identical in structure. Both contained a belief that the mine was not vulnerable to the hazard in question. Furthermore, both involved a series of beliefs which enabled warning signs to be dismissed — by normalising the evidence, by introducing ad hoc criteria of danger and by discounting intermittent signs. These beliefs allowed management to continue production uninterrupted, at a time when all the indicators were that the mine was headed for disaster.

The striking similarity of the cultures of denial which operated in these two cases suggests the hypothesis that similar systems of belief may underlie other disasters. It would be instructive to analyse other disasters from this point of view. If similar cultures are in evidence, this will both advance our understanding of disasters and give added weight to the policy prescriptions suggested above.

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