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Many businesses are vulnerable to sudden and disruptive events that result in financial and reputational losses, and in some cases the death of employees or customers. Disaster management – comprising preparedness, response, and recovery – has become a prominent endeavour in recent decades.[1] Undergraduate and postgraduate degree courses in disaster management are now offered by some universities. Public and private sector entities have legal and moral obligations for the safety of the public and of their employees, and in a disaster are expected to respond effectively to minimise loss of life. It is surprising, then, that business historians have shown so little interest in industrial disasters and disaster management.[2]

The origins of disaster management in British industry are examined in this article with the help of a case study of the mine rescue network in Yorkshire in the early twentieth century. Colliery companies in Yorkshire were prominent in the development of mine rescue practices and technology. Yorkshire was home to the UK's first mine rescue stations, which were built and equipped on private initiative. Coalowners in Lancashire and South Wales followed Yorkshire's example, voluntarily establishing their own mine rescue stations. After 1910, the government intervened to compel the adoption of mine rescue systems throughout the UK.

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[1] Coppola, *Introduction to International Disaster Management*; Singleton, *Economic and Natural Disasters*.

[2] Financial crises and disasters have proved much more popular research topics, but here we focus on industrial disasters that cause physical as well as financial damage.

This article is the first to use the archives of British mine rescue stations. Minute books, reports, letters, and accounts have survived for three of the six pre-nationalisation mine rescue stations in Yorkshire. Rotherham Archives and Local Studies holds the records of the Rotherham and District Rescue Station (reference 185-B/9), including the minute books of the meetings of the Representatives of Rescue Stations in the Yorkshire & North Midland Inspection Division. Sheffield City Archives contains the records of the Wath Joint Rescue Station (reference COAL/Y2) and Tankersley Joint Colliery Rescue Station (references MD3479-3482 and COAL/NC/10). The surviving evidence of other Yorkshire mine rescue stations is more fragmentary. Archival materials also exist for mine rescue stations on other coalfields, again with large gaps in coverage.[3]

The first section reviews academic literature on industrial disasters in Britain. The industrial context and the role of coalowners and managers are introduced in section two. Section three discusses the causes of underground explosions and fires and assesses their costs, both human and commercial. The fourth section examines the complementary strategies of disaster prevention and disaster response. The introduction of disaster management legislation in the UK coal industry is discussed in section five, which also examines the content of the ensuing regulations and the main types of breathing apparatus. The establishment of a network of mine rescue stations in Yorkshire is the theme of section six. Section seven examines an early disaster management manual developed in Yorkshire. Section eight evaluates the

[3] For example those of the Leicestershire and South Derbyshire rescue station at Ashby-de-la-Zouch are held by the Leicestershire, Leicester and Rutland Record Office.

effectiveness of the mine rescue network with special emphasis on incidents at Wharncliffe Silkstone, Hamstead, and Cadeby Main collieries.

The mine rescue network offered the coal industry several advantages at a modest cost. Mine rescue equipment and teams could be used to fight fires and outbreaks of gas before they caused an explosion, and to repair damaged mines after a disaster, as well as to explore a stricken mine to locate and rescue survivors. In the decade before mine rescue facilities became mandatory, their provision signalled to miners and the public that *some* employers took safety and rescue seriously. Disaster management was also a field in which the typically fractious coalowners could cooperate without detriment to their employees.

I

In this journal, Herbane examines the development of business continuity management (BCM) – a form of crisis management – in the late twentieth century. Herbane is concerned with how businesses plan to ensure their survival in the event of computer failure and loss of data, fire, flood, hurricane, and terrorism. BCM, he argues, was first and foremost a response to the vulnerability created by dependence on computers.[4] But the academic analysis of disaster management may be traced back to the research of a sociologist, Samuel Prince, into the Halifax (Nova Scotia) explosion of 1917, when two ships, one carrying munitions, collided in the harbour, wreaking havoc on the city and its inhabitants.[5] The current article reaches back a little further into the closing years of the nineteenth and the turn of the twentieth century to unearth the origins of disaster management in coal mining.

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[4] Herbane, “Business Continuity Management.”

[5] Singleton, *Economic and Natural Disasters*, pp. 12-13; Prince, *Catastrophe and Social Change*.

Industrial disasters and disaster management are relatively, but not completely, neglected by business and other historians of the UK.[6] Tay Bridge disaster is presented by Pinsdorf as a 'museum of management mistakes.'[7] Writing about the Tay Bridge in the wake of a spate of transport disasters in the 1980s, Henderson compares disaster management failures in the 1870s and in the late twentieth century.[8] The *Titanic* and *Torrey Canyon* shipping disasters are considered from the perspective of behavioural economics and environmental history respectively.[9] Giles examines Victorian railway accidents, focussing on the liability (or absence thereof) of employers to the workforce, and in this journal Fowler discusses the compensation of passengers involved in accidents on the London tube.[10]

Much more has been written on the diseases suffered by miners than on mine accidents and disasters.[11] But violent deaths and injury have not been ignored. Labour history offers one way into the topic. Mills investigates the evolution of regulation in British coal and metalliferous mines between 1800 and 1914; Selway examines how mining accidents and disasters in South Wales are remembered by miners and their communities; and Phillips discusses mining accidents and disasters

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[6] Other countries are no better served but lack of space precludes further discussion.

[7] Pinsdorf, "Engineering Dreams."

[8] Henderson, "British Approach to Disaster Management."

[9] Frey, Savage and Torgler, "Behavior Under Extreme Conditions;" Sheail, "Torrey Canyon."

[10] Giles, "Railway Accidents;" Fowler, "Compensating Passengers."

[11] McIvor and Johnston, *Miners' Lung*; Bufton and Melling, "Coming Up For Air;" Perchard and Gildart, "Buying Brains and Experts."

in Scotland before and after nationalisation.[12] Woodhead's article on the Bentley (1931) explosion near Doncaster is a work of oral history.[13] Williamson's volume on the Gresford (1934) disaster in North Wales is weighted towards the politics of the official investigation.[14] The political and social aspects of the Aberfan disaster (1966), when a waste tip collapsed and buried a primary school, are well researched.[15] Only a few studies of UK mining disasters are written by business historians. Harvey's article on the Oaks (1866) explosions at Barnsley shows how coalowners influenced the drafting of safety legislation, and colluded with sympathetic members of H.M. Mines Inspectorate to ensure lax enforcement.[16] Singleton's study of Senghenydd (1913), Britain's worst mining disaster, shows how the tragedy unfolded in stages in accordance with a disaster management cycle.[17] Reveley and Singleton compare the management and regulatory failures that led to disasters in British coal mines in the twentieth century and at Pike River in New Zealand in 2010.[18] A detailed study of mine safety and accidents on the Warwickshire coalfield between 1840 and 1913 is contained in the PhD thesis by Anney.[19]

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[12] Mills, *Regulating Health and Safety*; Selway, "Death Underground;" Phillips, *Scottish Coal Miners*, pp. 80-109.

[13] Woodhead, "The Bentley Colliery Disaster."

[14] Williamson, *Gresford*.

[15] McLean and Johnes, *Aberfan.*

[16] Harvey, "The Oaks."

[17] Singleton, *Economic and Natural Disasters*, pp. 107-123.

[18] Reveley and Singleton, "Carbon Copy."

[19] Anney, "Death on the Warwickshire Coalfield."

The current article extends this research by investigating how British colliery companies, especially in Yorkshire, dealt with what we (but not they) would call disaster management in the early years of the twentieth century.

II

The role of management – and not miners or the inspectorate – in disaster management is given priority in this article. Directors and large shareholders of mining companies were known as coalowners. Their representative at the colliery, known as the agent, monitored and gave instructions to the mine manager. Each colliery required a statutory manager who bore legal responsibility for safety. Managers and undermanagers required certificates of proficiency. Many coalowners and managers were members of one of the regional 'institutions' of mining engineers; indeed there were 1.2 mining engineers per mine in 1914.[20] Safety was held up by the institutions as a key concern.[21] A minority of enthusiastic members attended meetings of the mining institutions, and it was this self-selected group that took most interest in rescue organisation and technology.

Coalowners were not a monolithic group. They engaged in intense competition and often had fractious relations with their neighbours not to mention their workers.[22] They joined together reluctantly on a district basis in reaction to the formation of trade unions.[23] Separate coalowners' associations were set up in West and South Yorkshire, often treated as distinct coalfields, in the second half of the nineteenth century. Yorkshire coalowners varied in their attitude to trade unionism

[20] Church, *British Coal*, p. 429.

[21] Strong. *Institution of Mining Engineers*.

[22] Outram, "Class Warriors."

[23] Church and Outram. *Strikes and Solidarity*, pp 46-48.

and were by no means uniformly hostile, as Dintenfass shows in case studies of the firms of Henry Briggs and Waterloo Main.[24] The 1890s saw considerable unrest on the Yorkshire coalfield. After an interlude of relative calm in the early 1900s, conflict in the mining industry surged after 1907. Wages, conditions, and new technology were the main issues, although private ownership of the mines came under attack, especially in South Wales. Competition between Labour and the Liberals for the allegiance of miners and their leaders intensified. Although Yorkshire shared in the coalfield unrest, it did not exhibit the militancy common in South Wales and Scotland.[25] Coalfield industrial relations remained volatile during and after the First World War. In the 1920s and 1930s, relations between mine managers, who were essentially employees, and the coalowners degenerated, as the latter fought to reduce costs. Safety was increasingly weaponised in the day to day conflict between miners, managers, and coalowners.[26]

As well as dealing with union issues, coalowners' associations acquired other functions of common interest: the minute book of the West Yorkshire Coal Owners Association for 1906-10 records details of negotiations with railway companies, the regulations pertaining to bobbinite explosive, a donation to Leeds University, and the pros and cons of mine rescue stations, in addition to the standard fare of wages and

[24] Dintenfass, *Managing Industrial Decline*.

[25] Church and Outram, *Strikes and Solidarity*, pp. 82-83; Baylies, *Yorkshire Miners*.

[26] Melling, "Safety, Supervision and the Politics of Productivity;" Perchard, *Mine Management Professions*.

strikes.[27] Members' attitudes to mine safety and rescue ranged from the enthusiastic to the indifferent.

Mining disasters exacerbated an already febrile industrial climate, seemingly demonstrating the callousness of management and the ineffectiveness of government. Action in the sphere of disaster management was increasingly attractive to some in the coal industry and in government, partly but by no means only as a means of appeasing the workforce.

III

There were often over one thousand fatalities per annum in British coal mines in the early twentieth century. Most deaths and injuries were caused by roof collapses, other falls of rock, and haulage accidents. But firedamp (methane) and/or coal dust explosions and fires were more visible because they could inflict numerous casualties. Most of those killed in disasters were asphyxiated by afterdamp (carbon monoxide) given off by burning coal and wood. Some mines were gassier than others. When firedamp comprised between roughly 5 and 15 per cent of the air it became explosive. One purpose of ventilation was to keep the proportion of firedamp well below 5 per cent. Among the possible sources of ignition were a broken safety lamp, careless use of explosives, defective electrical apparatus, spontaneous combustion due to chemical reaction, and (though prohibited in gassy mines) smoking. By 1900, it was understood that the coal dust which coated surfaces underground was also highly inflammable. Coal dust explosions could be triggered

[27] University of Leeds Archive, MS148/3, West Yorkshire Coal Owners' Association, Minute Book no. 3.

by firedamp explosions, but could also occur independently.[28] Human error, poor design and maintenance of mines and equipment, weakly enforced regulation, and the inadequacy of Victorian science all played a part. Commercial pressure resulted in safety being traded off to maximise production, profits, and the earnings of piece workers.[29]

Under early-twentieth century workmen's compensation legislation, the courts awarded a lump sum of approximately three years' wages to the beneficiaries of a miner killed at work.[30] Insurance companies were set up by coalowners to meet the cost of compensation.[31] Detailed evidence of other costs incurred by coalowners in explosions or fires is harder to find. Typically, however, it took several months to restart production after a major incident. Fires had to be extinguished, the ventilation restored, gas extracted or sealed off, falls of rock cleared, roadways rebuilt, equipment replaced, and the bodies of victims removed.

One of the fullest surviving accounts is that of the recovery of Altofts colliery in Yorkshire following an explosion that killed 22 men and boys on 2 October 1886. Altofts normally produced 1000 tons of coal per day. Coal getting resumed on 13 January 1887, albeit at a reduced rate. By February production was back to half of

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[28] Boyns, "Technical Change;" Jones, "Towards Safer Working;" Davies, "Carbon Monoxide Poisoning."

[29] Reveley and Singleton, "Carbon Copy."

[30] Singleton, *Economic and Natural Disasters*, p. 116; Silvestre, "Workplace Accidents," pp. 77-78.

[31] Rotherham Archives and Local Studies [hereafter RALS], 63-B/6/4/8, The Yorkshire Coal-Owners' Mutual Indemnity Company Limited, Memorandum and Articles of Association, 9 June 1898.

the pre-disaster level, and full production was restored at last in April 1887.[32] As well as recovery costs, the company, Pope and Pearson, lost about five or six months of production and profit. Disasters were so disruptive that firms had much to gain from minimising fires and explosions, and responding quickly in an emergency, in other words for taking disaster management seriously.

IV

Disaster management in the coal industry exhibited two aspects. One addressed the causes of disasters with a view to reducing their frequency. The other involved enhanced preparedness, the reassertion of control in an emergency, and efforts to save lives. John Scott Haldane, a physiologist at Oxford University and director of the Doncaster coalowners' research laboratory, was convinced of their complementarity: 'prevention and cure are in reality as intimately connected in the work of a mining engineer as in that of a doctor'.[33]

Technological, regulatory, and scientific factors were central to the preventive approach. Murray and Silvestre argue that small improvements in mining technology, including the introduction of better safety lamps, more robust cages, safer explosives, and better ventilation systems, contributed to falling aggregate fatality rates in coal industries around the world in the late nineteenth century.[34] But technology also brought new risks. Mechanical coal cutters generated more inflammable coal dust than manual coal getting. Primitive electrical equipment was not spark proof and could easily cause an explosion.[35]

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[32] Garforth, *Suggested Rules*, pp. 52-72.

[33] Haldane, "Possibilities of Rescue-Work," p. 469.

[34] Murray and Silvestre, "Small-Scale Technologies."

[35] Jones, "Towards Safer Working."

Miners and their unions had campaigned for safety regulation since the early nineteenth century, and the results were impressive, at least on paper.[36] By 1900 safety regulation covered the use of explosives and safety lamps, ventilation, the monitoring of gas levels, and the removal of men from danger. Regulations were updated frequently, often after a disaster.[37] But there were never enough government inspectors to examine each mine thoroughly. A labyrinth of murky tunnels was inherently harder to inspect than a factory. Governments, moreover, declined to spend large sums on inspection and enforcement, compelling H.M. Mines Inspectors to regulate by persuasion. As former mine managers with mining engineering qualifications, inspectors were predisposed to sympathise with the difficulties faced by management in running a profitable mine.[38]

Prior to the First World War the intractable problem of coal dust explosions undermined disaster prevention, leading to more emphasis on disaster preparedness and response. The coal dust problem was rendered acute by a series of disasters in Britain, the USA, and continental Europe.[39] Debate raged over the most effective way of avoiding such explosions. The options were removing coal dust from the pit, spraying it with water, or spreading inert stone dust over it. W.E. Garforth, managing director and later chairman of Pope and Pearson, built an experimental gallery at Altofts for use in research into coal dust explosions. Experiments at Altofts and elsewhere supported the stone-dusting solution, but it was not until 1915 that the results were accepted as conclusive. Stone-dusting became compulsory in revised

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[36] Mills, *Regulating Health and Safety.*

[37] Bryan, *The Evolution of Health and Safety in Mines*.

[38] Harvey, “The Oaks;” Williamson, *Gresford*; Reveley and Singleton, “Carbon Copy.”

[39] Aldrich, "'Needless Peril of the Coal Mine;” Neville, “Courrières Colliery Disaster.”

regulations issued in 1920; it was effective if implemented carefully and the stone dust used in the right proportions, conditions that could not be guaranteed.[40]

Until 1920, then, disaster preparedness and response took on added significance. Great bravery was shown by rescuers equipped with little more than stretchers after Victorian mine explosions. Such operations, which were conducted without adequate training and preparation, placed the rescuers in great danger. A second explosion at the Oaks in 1866 killed 27 members of the party searching for survivors of the first.[41] A more systematic approach to preparedness and response was required.

The nineteenth century public was increasingly unwilling to abandon the victims of disaster to their fate. The Royal National Lifeboat Institution was founded in 1824. Neglect of the dying and wounded on the battlefield prompted the formation of the International Red Cross in Switzerland in 1863. Military medicine, surgery, and nursing were improving, spurred on by public demand for humane treatment of combatants. Societies were formed to promote safety, and to honour the bravery of members of the public (including miners) who showed courage in rescue attempts.[42] First-aid teams, trained under the auspices of the St Johns Ambulance Brigade, were established in many UK coal mines.[43]

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[40] Garforth, “Origin of the Principle of Stone-Dusting;” Royal Commission on Safety in Coal Mines, *Report*, pp. 353-355.

[41] Duckham, “Oaks Disaster.”

[42] Hutchinson, *Champions of Charity*; Price, “Heroism in Everyday Life;” Harrison, “Medicine and the Management of Modern Warfare.”

[43] Royal Commission on Mines, *Second Report*, pp. 170-173.

New technology in the form of apparatus enabling the wearer to breathe in an irrespirable atmosphere transformed mine rescue. Experimental breathing apparatus, designed on the same principle as diving gear, was deployed in rescue operations at Killingworth Colliery, Northumberland in 1882.[44] Alan Bagot, an engineer, wrote a pamphlet in 1883 advocating a network of mine rescue stations, where breathing apparatus was stored for despatch by rail to the scene of an explosion.[45] Rescuers wearing the apparatus would search for survivors, extinguish fires, and reset the ventilation system. German, Austrian, British, and French designers vied for technological leadership in the design of breathing apparatus.[46]

The Courrières disaster in France (1906) prompted urgent debate over mine rescue systems in Britain and on the continent.[47] The UK then had two mine rescue stations, at Altofts and Tankersley, both in Yorkshire. Collieries in Austria and Saxony were already required by law to keep sets of breathing apparatus. France followed suit in the wake of Courrières. Although Westphalian collieries were not compelled to maintain breathing apparatus, some of the larger ones had their own well-appointed rescue stations. Several Westphalian rescue teams were deployed at Courrières.[48] The UK Royal Commission on Mines indicated in 1907 that it would welcome the establishment of more rescue stations on the coalfields, but it refrained

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[44] Foregger, “Development of Mine Rescue.”

[45] Bagot, *Life Brigades*.

[46] Department of Scientific and Industrial Research Advisory Council. *First Report.*

[47] An Engineering Correspondent, “Rescue Work in Mines,” *The Times*, 18 March 1908, p. 3.

[48] Royal Commission on Mines, *First Report*, pp. 8, 44, 50; Meyer, “Rescue-Apparatus.”

from demanding compulsion. The Royal Commission argued that further work was needed to perfect the various models of apparatus (both British and foreign) before they could be used with confidence in their safety.[49] Better organisation and training could prove equally, if not more, effective in saving miners' lives.

The Home Office wrote to coalowners in 1908 to ascertain their plans for building rescue stations.[50] Mine rescue stations were operational at Altofts, Tankersley, and Wath in Yorkshire, Howe Bridge in Lancashire, and Aberaman in South Wales by January 1909, but most districts still had no cover.[51] In their second report, published in 1909, the Royal Commission warned that legislation was probable unless other coalowners bestirred themselves in relation to disaster management.[52]

V

Innovative disaster management legislation was enacted for the coal industry in 1910 and 1911. It was innovative in several respects. Firstly, it added an emphasis on disaster response to long-established concerns for accident and disaster prevention in mining, transportation, and other hazardous activities.[53] Secondly, it created a national rescue network that was required to meet certain statutory requirements for the level and efficiency of service, albeit without sacrificing private ownership. By contrast, the fire service in the early

[49] Royal Commission on Mines, *First Report*, pp. 10-11.

[50] Rescue Regulations Committee, *Report*, p. 7.

[51] Royal Commission on Mines, *Second Report*, p. 166.

[52] Royal Commission on Mines, *Second Report*, p. 170.

[53] Mills, *Regulating Health and Safety*; Crook and Esbester, *Governing Risks*; Giles, "Railway Accidents."

twentieth century was in the hands of local authorities, and there was no statutorily enforced standard of provision. It was not until the 1930s that national standards and a coordinated system began to emerge in the fire service.[54]

The tipping point was the Wellington Pit disaster near Whitehaven in 1910, which claimed 137 lives. No breathing apparatus was available on the West Cumberland coalfield, and there was a lengthy delay whilst help was summoned from Sheffield and Newcastle.[55] **The miners' unions and the Labour Party were incandescent with rage over the Whitehaven explosion, and there were disturbances at the pit when the rescue was abandoned and the affected area sealed off. Agitation grew for more thorough inspection, stronger enforcement of the law, and better rescue facilities.[56] Keir Hardie, leader of the Labour Party, told an audience at Egremont, Cumberland that the neglect of safety under private ownership reinforced the case for nationalisation of the mines; thus the issue of safety was becoming more politicised.[57] Even the newspaper of the elite, *The Times*, reported extensively and sympathetically on the Wellington Pit tragedy, which had focussed 'public attention … [on the] whole**

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[54] Ewen, "Central Government."

[55] Redmayne and Pope, *Explosion and Underground Fire at the Wellington Pit*. Whether lives would have been saved if apparatus had been nearby is unknown. With luck and discipline, miners *could* sometimes survive for several days if they built stoppings to protect themselves from gas. Punke, *Fire and Brimstone*.

[56] Enoch Edwards, HC Deb., 16 June 1910, vol. 17, cols 1474-1480.

[57] **"Mr Keir Hardie on Pit Disasters: The Whitehaven Fire 'Profits Against Safety.'" *Manchester Guardian*, 26 July 1910, p. 5.**

question of the further prevention of such accidents,' a cause that would attract all party support.[58] Reflecting on the public reaction to the Whitehaven disaster, the chairman of the West Yorkshire Coal Owners' Association observed that the matter of rescue stations and apparatus had become 'acute' and legislation unavoidable.[59] In other words, the coalowners had lost the initiative to the state in the field of mine rescue.

Winston Churchill, the Home Secretary, felt compelled to respond to the pressure for reform arising from the Whitehaven disaster. The Mines Accidents (Rescue and Aid) Act, 1910, and the Coal Mines Act, 1911, laid the foundations for a national mine rescue system. Regulations published in 1913 and 1914 made it compulsory for all collieries (with some exceptions including those with fewer than 100 workmen) to maintain breathing apparatus and train rescue brigades in their use. Apparatus could be held offsite if there was a central rescue station within ten miles. The costs of the rescue network would be borne by coalowners in each district. Two configurations of rescue station were permitted: some had a 'permanent corps' of about six professional rescuers, who travelled with the breathing apparatus, and took their turn alongside colliery rescue brigades, but most dispensed with the permanent corps, and focussed on looking after the apparatus and training volunteer rescuers from the collieries.[60] Some collieries also kept several sets of apparatus onsite.

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[58] "Accidents in Mines (Editorial)." ***The Times*****, 18 June 1910, p. 11.**

[59] University of Leeds Archive, MS148/3, West Yorkshire Coal Owners' Association, Minute Book no. 3, Meeting on 28 June 1910.

[60] Bulman and Mills, *Mine Rescue Work and Organization*, pp. 143-149; Mines (Rescue and Aid) Committee, *Report*; Rescue Regulations Committee, *Report*, pp. 8-9.

Compliance was now the order of the day. By 1921 there were 49 mine rescue stations on British coalfields and 1758 sets of approved breathing apparatus.[61] Yorkshire was no longer in a special position.

Several types of breathing apparatus were available. The most common, the compressed oxygen system, worked on the same principle as modern scuba diving equipment. Cylinders of compressed oxygen were worn on the back and connected by a tube to the mouthpiece. Exhaled air passed through another tube into a bag worn on the chest where it was filtered and 'regenerated' for reuse. A few rescue stations opted for the liquid air system which dispensed with heavy oxygen cylinders. Liquid air was produced at the rescue station and conveyed to the scene in fragile vacuum flasks. It was poured into a pack on the back of the rescuer and connected by a tube to the mouthpiece. Exhaled air was filtered in a breathing bag and regenerated.[62] The liquid air system required the installation of bulky and expensive machinery at the rescue station, but running costs were much lower than with the compressed oxygen system which required the purchase of oxygen supplies from external suppliers.[63]

Regulations specified how many rescue teams or brigades must be provided by each size of colliery. Under the 1920 regulations, for example, a medium sized

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[61] Mines Department, *First Annual Report*, pp. 132-133.

[62] For the most accessible overview see McAdam and Davidson, *Mine Rescue Work*, pp. 5-21, 35-47. See also Department of Scientific and Industrial Research Advisory Council, *First Report of the Mine Rescue Apparatus Research Committee.*

[63] RALS, 185/B/9/1/1, Rotherham and District Rescue Station Board, Notes on a Visit to the Northumberland and Durham Fire and Rescue Station at Elswick, on Wednesday, Oct 1st 1913; Bremner, "The Heylandt Liquid Air Plant."

colliery of 700-1000 men, served by a rescue station without a permanent corps, required three volunteer brigades of five men each. A similar sized colliery linked to a rescue station *with* a permanent corps could make do with three trained rescuers.[64] Junior mine officials were often given preference since they were deemed more reliable than other workmen, and it is recorded that 87 per cent of the rescue men trained by one unnamed rescue station, 'belonged to the class of colliery officials, mostly overmen and deputies.'[65] Arthur Winborn, superintendent of Tankersley rescue station, considered that volunteers should be aged between 22 and 45. Only men of 'strictly temperate habits' were acceptable, whilst those 'of an obviously nervous or excitable temperament should not be admitted' in case they panic.[66] Applicants were given a medical examination. The Home Office set minimum requirements for training: not less than twelve sessions of at least two hours each in the apparatus, some in a hot or irrespirable atmosphere, were prescribed. Trainees had to perform arduous tasks in the apparatus, including building temporary stoppages and carrying a body or dummy to safety. They had to dismantle and reassemble the apparatus and check for leaks. Qualified rescue men were obliged to practice once a quarter in their apparatus.[67] A total of 6500 rescue men had been trained nationwide by 1919.[68]

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[64] Bulman and Mills, *Mine Rescue Work and Organization*, pp. 9-10.

[65] Bulman and Mills, *Mine Rescue Work and Organization*, p. 11.

[66] Winborn, “Suggestions for the Organization of Colliery Rescue-Brigades,” p. 90.

[67] RALS, 185/B/9/5, Rotherham and District Rescue Station Board, Rules and Regulations, 4 January 1916; Bulman and Mills, *Mine Rescue Work and Organization*, pp. 1-8, 13-36; Sheffield City Archives [hereafter SCA], COAL/Y2/5/7, Wath Joint Rescue Station, Organization, Establishment, Training and Rules, 1932;

But doubts persisted as to the reliability and safety of breathing apparatus. Haldane was asked to advise Doncaster coalowners on the best make of apparatus for their new rescue station. A leader in the field of academic-industrial collaboration, Haldane published his sobering findings in *Transactions of the Institution of Mining Engineers* [hereafter *Transactions*] in 1914. Haldane regretted that the government had made the acquisition of breathing apparatus compulsory without ensuring its safety: 'a number of serious and more or less dangerous defects exist in [all] rescue-appliances at present in use in this country, and in the manner of using them.'[69] He was unable to recommend any brand of breathing apparatus until modifications were made. Later that year, however, he endorsed an improved version of the Proto compressed oxygen apparatus, manufactured by Siebe-Gorman of London, Britain's leading producer of diving apparatus.[70] The Proto, adopted by the British Army for use in mine rescue on the Western Front,[71] became the most popular model of breathing apparatus in UK coal mines between the wars.

The persistent coal dust problem, combined with public disquiet over disasters and simmering unrest in the coal industry, prompted the Liberal government to pass legislation to force coalowners to establish disaster management organisations in the form of mine rescue stations.

COAL/Y2/5/9, Wath Joint Rescue Station, Rule Book and Manual of Instruction, 1939.

[68] Bulman and Mills, *Mine Rescue Work and Organization*, p. 9.

[69] Haldane, "Self-Contained Rescue-Apparatus for Use in Irrespirable Atmospheres," p. 776.

[70] Haldane, "Self-Contained Rescue-Apparatus and Smoke-Helmets."

[71] Logan, "The Difficulties and Dangers of Mine-Rescue Work."

VI

Mine rescue stations were by no means the first permanent rescue facilities to be established in the UK. The National Institution for the Preservation of Life from Shipwreck (later the RNLI) was founded on a voluntary basis in 1824, and came to operate lifeboats and stations around the British Isles.[72] Most towns and cities acquired municipal fire stations and fire brigades during the nineteenth century, often succeeding the fire brigades of the insurance companies.[73] Whereas the lifeboats and the fire brigades sought to save the lives of passengers and the general public, as well as property and the lives of employees, the mine rescue stations had no role in aiding and rescuing the general public because they did not go into mines. The mine rescue network, then, constituted a significant departure in the development of disaster response.

Mine rescue stations were launched to considerable fanfare. In an era of public alarm over mining disasters, combined with increasingly testy industrial relations, these events offered coalowners favourable publicity. The *Manchester Courier* published a glowing report of the new Howe Bridge rescue station near Manchester in 1908. Readers were informed that Lancashire and Cheshire coalowners had invested £1200 on a modern and efficient facility designed to save lives.[74]

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[72] Mortimer, "175 Years of the RNLI."

[73] Ewen, "Central Government;" Brown, "Belfast Fire Brigade."

[74] "Life-saving in Mines." *Manchester Courier and Lancashire General Advertiser*, 3 April 1908, p. 9.

But Yorkshire had led the way in mine rescue stations, not least through the enthusiasm of Garforth. A prototype mine rescue station was established at Altofts in 1901. It included a gallery where mine officials and workmen could practice wearing breathing apparatus in an irrespirable atmosphere. One of Garforth's objectives was to demonstrate the merits of mine rescue stations to other coalowners.[75] German breathing apparatus was used at Altofts until superseded by Garforth's own WEG apparatus.[76]

Tankersley, the first joint mine rescue station, serving the collieries of several companies, was completed in 1902, although training in lifelike conditions did not start until 1905.[77] The impetus for Tankersley came from George Blake Walker of Wharncliffe Silkstone Colliery. Walker warned his neighbours that disaster could strike at the 'most unexpected moment'.[78] Wharncliffe Silkstone, Newton Chambers and Barrow Haematite Steel agreed to share the costs of building and operating a rescue station, equipped with breathing apparatus, a training gallery, and accommodation for an instructor.[79] The rescue station at Tankersley cost £671 to build and fit out with compressed oxygen breathing apparatus imported from

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[75] Garforth, "Experimental Gallery for Testing Life-Saving Apparatus."

[76] Garforth, "A New Apparatus."

[77] SCA, MD3479, Tankersley Note and Minute Book, undated, p. 6. By 2017, the former Tankersley joint rescue station was occupied by the Café 334 Coffee House and Bistro and the Skin & Tonic Beauty and Hair Salon.

[78] SCA, MD3482, Tankersley Rescue Station (Formation) G.B. Walker to M.H. Habershon, 17 November 1898.

[79] SCA, MD3482, M.H. Habershon to W. Allott, 31 October 1900; Habershon, "A Joint Colliery Rescue Station."

Germany at a cost of £12 10s per set. Costs were borne equally by the three firms; they also paid an annual subscription of £35 each, rising to £50 in 1907, to meet running expenses.[80] Given that the average weekly wage of miners in Lancashire, Yorkshire and the Midlands was £1 13s 3d in 1902, these sums were not onerous.[81]

Coalowners around Wath-on-Dearne resolved to establish a further joint rescue station. H.M. Mines Inspectorate took a close interest in this project, and William Walker, Inspector of Mines in the Doncaster area, was invited to sit on the supervisory committee, illustrating the close relations between regulators and coalowners. Five firms subscribed initially.[82] Union representatives were not invited to become involved in rescue station oversight – the coalowners were paying and expected to keep control. Wath began training volunteer rescuers in March 1909. Each colliery mustered three volunteer brigades of five men each.[83] Annual running costs in 1910 were £700, or £100 per colliery, several more firms having joined.[84]

But some Yorkshire coalowners procrastinated until it became compulsory to build central rescue stations. Between 1911 and 1918, further rescue stations were

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[80] Habershon, “The Work of a Joint Colliery Rescue-Station,” p. 256; SCA, MD3479, Tankersley Note and Minute Book, undated, p. 4.

[81] Hopwood, “Wages and Profits in Coal Mining,” p. 8.

[82] SCA, COAL/Y2/1/1, Wath Rescue Station, minutes, 29 June 1906; 10 October 1906.

[83] SCA, COAL/Y2/1/1, Wath Rescue Station, minutes, 25 November 1908; Note on Wath Rescue Station, 2 March 1910.

[84] SCA, COAL/Y2/1/1, Wath Joint Rescue Station, minutes, 2 March 1910.

opened at Barnsley, Brierley, Doncaster, Rotherham, and Wakefield.[85] The records of the Rotherham rescue station have survived, allowing us to explore the attitudes of coalowners in Sheffield and Rotherham to disaster management. A meeting was called in Sheffield in May 1912 to discuss a proposal to build a rescue station at Rotherham. Archbold Blenkinsop of Dalton Main Colliery emphasised the need 'at once to set about complying' with government requirements. Wath and Tankersley were too distant from some Sheffield and Rotherham collieries for membership of those stations to satisfy the authorities.[86] Although the government would give coalowners some time for building and training, sooner or later their patience would run out. It was resolved to establish a rescue station at Rotherham on the site of a former ice rink.[87] Early in 1914, a trustee of the rescue station expressed concern that, whilst construction was complete, the breathing apparatus had not arrived, exposing coalowners to possible official censure and reputational damage: 'We

[85] For an overview of the facilities at these stations (excepting Altofts and Doncaster) see TNA, DSIR36/417, Some Particulars of Brierley Rescue Station S. Yorkshire, November 1917; Record of Visits of the [Mine Rescue Apparatus Research] Committee to Rescue Stations in Yorkshire, November 28th and 29th 1917.

[86] RALS, 185/B/9/1/1, Mines Accidents (Rescue and Aid) Act 1910: Statutory Rules and Orders, 1912, No. 347, Report for Presentation to a Meeting to be Held at Victoria Hotel, Sheffield, on Wednesday, May 15th, 1912, for the Purpose of Considering the Establishment of a Central Rescue Station.

[87] RALS, 185/B/9/1/1, Rotherham and District Rescue Station Board, Minutes, 15 May 1912; 22 August 1912.

should all feel acutely the criticisms that would certainly be made if calamity overtook us.'[88] The rescue station became operational later that year.

Meticulous attention was given to the choice of breathing apparatus, and suppliers were invited to Rotherham for trials. Orders were placed for Aerophor liquid air sets – the 'least distressing to wear' according to the doctor in attendance – and Meco compressed oxygen sets; both types cost around £20 per set.[89] Modifications were subsequently made to the Aerophor at Rotherham and the variant used there became known as the Rotherham apparatus.[90] Operating on a larger scale than Wath, the Rotherham rescue station served the collieries of twelve companies and 25,000 miners. Its capital assets were valued at £8910 in 1915; annual running costs were £1595, equivalent to a modest 4s 2½d per 1000 tons of coal.[91]

Information was collected on the running costs of each mine rescue station in South Yorkshire in 1923. The figures are as follows: 12s per 1000 tons of coal raised at Rotherham and Wath; 8s at Doncaster; 7s 9d at Brierley; and a thrifty 5s at Tankersley. The cost of raising 1000 tons of coal in Yorkshire in 1927 was £760,

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[88] RALS, 185/B/9/1/1, Rotherham and District Rescue Station Board, Minutes, 17 January 1914.

[89] RALS, 185/B/9/1/1, Rotherham and District Rescue Station Board, Summary Taken from Dr Naylor's Notes, undated 1913; Record of Demonstrations with Various Apparatus at the New Rescue Station, 3 September 1913.

[90] Elliston, "The 'Rotherham' Rescue Apparatus."

[91] RALS, 185/8/9/1/2, Rotherham and District Rescue Station Board, General Meeting on March 31, 1914; Secretary's Report & Balance Sheet for Year Ending 30 June 1915.

hence the running costs of the mine rescue network were trivial in relation to production costs.[92]

Following improvements in roads, motor vehicles, and the telephone system, the government Mines Department increased the maximum permitted distance from colliery to central rescue station to 15 miles in 1928.[93] In the event, this opportunity to rationalise the Yorkshire mine rescue network was not taken, and all stations remained open. They were cheap to run, as well as a source of local pride. Rescue workers, moreover, could get to know conditions in each colliery better when the district served was small.[94]

Yorkshire's mine rescue stations provided the region's collieries with a modern disaster management infrastructure. Although Yorkshire was a pioneer, especially of the central rescue station model, it is not suggested that the contribution of other regions was negligible. The efforts of Westphalian and Lancastrian collieries are noted above. Coalowners and mining engineers in the North East were also innovative. The Durham and Northumberland Collieries Fire and Rescue Brigade (DNCFRB) opened a mine rescue station at Elswick, Newcastle in 1910. W.C. Blackett and F.P. Mills, both leading lights of the DNCFRB, made

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[92] SCA, COAL/NC/10/6, South Yorkshire Coal Trades Association, Meeting at Sheffield re Amendment of Rescue Regulations etc, 28 June 1923; Buxton, "Coalmining," p. 65.

[93] Mines Department, *Eighth Annual Report*, p. 34; Rescue Regulations Committee, *Report*, pp. 13-14.

[94] SCA, COAL/NC/10/7, W. Hay to T.H.B. Young, 19 February 1929; RALS, 185/8/9/1/2, Rotherham and District Rescue Station Board, AGM minutes, 2 October 1929.

significant improvements to the Aerophor, and Mills co-authored a textbook on mine rescue.[95] Possessing infrastructure and equipment for disaster management was one thing, but knowing how to use them was another, and it is to this aspect that we now turn.

VII

Disaster response is more effective if those involved are well-prepared, trained, and led. Each emergency is different, and those making decisions must try to remain calm and think logically and creatively. Much rests on the degree to which leaders are trusted by subordinates. Reflecting on experience as a manager at Altofts in 1886, Garforth drafted a disaster management manual, publishing it in *Transactions* in 1897-98. Garforth's "Suggested Rules" could be read by the hundreds of mine managers and engineers with access to that journal. Being well versed in "Suggested Rules", argued Garforth, would help the mine manager decide what to do in an emergency, and overcome 'the feeling of helplessness' after an explosion that interfered with 'that clearness of judgement which is essential at such a critical moment.'[96]

The first part of "Suggested Rules" dealt with precautions. Colliery officials should give careful thought to the prevention of accidents, and to how they might respond to an explosion or fire. There should be a plan for allocating mine officials to each task involved in exploring a stricken mine. Emergency ventilation and winding equipment should be kept onsite, and a system of water pipes connected to the surface. Detailed and accurate maps of the colliery were essential. Miners should be

[95] Blackett, "Fire and Rescue Station;" Bulman and Mills, *Mine Rescue Work and Organization.*

[96] Garforth, "Suggested Rules," p. 497.

trained to find alternative routes back to the shaft, since the usual one might be blocked. The ambulance corps must practice regularly, and be issued with sufficient bandages, compressed oxygen flasks and other necessities.[97]

The second part dealt with how to proceed after an explosion. H.M. Inspector of Mines, all emergency officials of the colliery, and the doctor should be summoned. Each official was to receive written orders. A record must be kept of all action taken. Colliery plans should be examined, and surface arrangements checked for damage to winding gear and ventilation fans. The first exploration team, led by the manager or undermanager, should descend when feasible, explore the shaft bottom, test for gas, and render assistance to the injured in the vicinity. Whichever manager was not underground should take control on the surface. Subsequent parties of at least six men each should explore further inside, working in relays, but they must not overexert themselves, and must withdraw if meeting afterdamp or fire. Bodies should not be retrieved during the first 24 hours, but priority given to extracting the living. Advice was given on how to treat gas poisoning. The ventilation system should be returned to normal as soon as possible using brattices and stoppings. Once management and their advisors (including inspectors and managers from neighbouring collieries) were satisfied that another explosion was unlikely, the work of recovery and repair could begin.[98] Garforth appended a couple of hypothetical case studies, and an account of operations following the 1886 explosion. “Suggested Rules” was brief and meant to be read by the manager on the way to the scene.

A second edition of *Suggested Rules* appeared in 1909, by which time Garforth had built and directed the Altofts mine rescue station, conducted coal dust

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[97] Garforth, “Suggested Rules,” pp. 500-504.

[98] Garforth, “Suggested Rules,” pp. 504-513.

experiments, designed the WEG breathing apparatus, and participated in more rescues.[99] Significant additions were made. Attention was drawn to the use of mice and small birds in testing air quality.[100] Explanations were given of the functions and organisation of central rescue stations, the training of rescue brigades, and the features of breathing apparatus. Colliery managers were advised to keep several sets of apparatus close to hand for immediate use. Instructions were provided for deploying rescue brigade with breathing apparatus. Rescue station staff were to assist the colliery manager and not take operational control. Apparatus must be checked before use, and only men in good health allowed underground. Clear orders were essential, and enough brigades summoned to conduct an operation lasting several days. Brigades were to act as scouts, exploring districts where ventilation was yet to be restored, putting out fires, and assisting survivors. Garforth acknowledged that the manager would need good judgement because the right course of action would not always be clear.[101]

Rule books issued by mine rescue stations described the training and duties of rescue teams and their leaders, often known as captains, but did not offer advice on the general organisation and conduct of rescue operations, responsibility for which lay with the colliery manager.[102]

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[99] Lloyd, “Memoir of the Late Sir William Garforth;” Garforth, “A New Apparatus.”

[100] Burton, “Risking Life and Wing.”

[101] Garforth *Suggested Rules*.

[102] SCA, COAL/Y2/5/7, Wath Joint Rescue Station, Organization, Establishment, Training and Rules, 1932; COAL/Y2/5/9, Wath Joint Rescue Station, Rule Book and Manual of Instruction, 1939.

A more substantial volume on mine rescue was published by two experienced practitioners, Bulman and Mills, in 1921. They described the selection and training of rescuers, the organisation of rescue stations, and the workings of breathing apparatus and ancillary equipment. Their book was meant to be read by aspiring colliery managers and included a selection of questions about rescue work from past examinations for the certificate of proficiency. One chapter reflected on the use of breathing apparatus in recent rescue and recovery operations.[103]

Blackett, the president of the Institution of Mining Engineers, contributed the foreword to Bulman and Mills. He predicted that compulsory stone-dusting would reduce the prominence of mine rescue.[104] In large measure this was correct. No dramatic advances occurred in mine rescue technology between the wars, whilst mine rescue was barely mentioned in the report of the Royal Commission on Safety in Coal Mines in 1938.[105] Deputies and overmen were less likely to volunteer for rescue work in the 1920s and 1930s than in earlier days; whether this reflected the worsening relations between supervisors and the colliery companies, or a loss of conviction in the importance of rescue work, is a moot point.[106] Yet disasters at Maltby Main, Bentley, Gresford, and elsewhere demonstrated that stone-dusting was not a panacea, and room remained for the additional assurance provided by mine rescue.

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[103] Bulman and Mills, *Mine Rescue Work and Organization*.

[104] Blackett, “Foreword,” p. vi.

[105] Royal Commission on Safety in Coal Mines, *Report*, pp. 13-14.

[106] RALS, 185/8/9/1/2, Rotherham and District Rescue Station Board, Meeting of Sub-committee Appointed to Meet the Rescue Workers, 5 March 1943.

"Suggested Rules" had a wide circulation. It stressed the benefits of training, planning, teamwork, clear communications, and the wherewithal to think creatively. Knowing what must be done, and the capacity to cope with the unexpected, were at least as important to disaster management as the latest breathing apparatus.

VIII

This section investigates the extent to which the mine rescue system in Yorkshire fulfilled its purpose as a disaster management agency by saving lives and property. Several prominent emergency operations are assessed against the guidelines offered in "Suggested Rules".

Rescuers trained and equipped by the Tankersley joint rescue station extinguished an 'alarming' underground fire at Wharncliffe Silkstone Colliery in 1907. Tankersley was only a mile from the colliery, and within 25 minutes of the request for aid being received, three sets of breathing apparatus from the station were in the hands of firefighters working on the blaze.[107] Colliery management stated that, if not tackled promptly and efficiently, the fire 'might have resulted in the stoppage of the mine for many months, with possible loss of life'.[108] Reflecting on this incident, George Blake Walker compared expenditure on rescue apparatus to an insurance premium: 'Rescue-appliances should repay their cost in the preservation of valuable property, in addition to the humanitarian idea of saving life.' Indeed, the 'cost incurred through one bad fire will pay for a large installation of rescue-apparatus.'[109] After an explosion at Norton Colliery in Staffordshire in 1912, rescue brigades wearing Proto breathing apparatus supplied by Stoke on Trent rescue station worked for 120 days

[107] Winborn, "Notes on Recent Experience."

[108] Wroe, "Notes on a Recent Underground Fire," p. 2.

[109] Walker, "On the Practical Use and Value of Colliery Rescue-Apparatus," p. 538.

to ready the mine for reopening. Without access to breathing apparatus, the recovery of the mine would have been more difficult, and even more costly.[110]

Yorkshire rescue brigades were less successful at Hamstead Colliery, near Birmingham, in 1908. At that time, the Birmingham district lacked a central rescue station and breathing apparatus. Fire broke out near the shaft bottom on 4 March 1908 when, through carelessness, a box of candles was set alight. The official report on Hamstead chided management for allowing miners unsupervised access to the candle box, and the practice of using of matches to burn through the string binding bunches of candles.[111] The efforts of colliery management and local volunteers to explore the mine failed, and at 11 pm – about 5 ½ hours after the accident – Garforth was telephoned for help. Rescuers from Altofts and Tankersley arrived the following day. There was only a slim chance of finding any of the 24 missing miners alive in view of the delay and the circulation of carbon monoxide, but the rescuers were determined to do what they could. Examined from the perspective of "Suggested Rules", the rescue operation, though brave, was poorly planned and executed. The Tankersley squad forgot to bring the force pump needed to recharge oxygen cylinders used with their Draeger compressed oxygen breathing apparatus. One of the Draeger sets developed a fault during exploration, suggesting that it had not been checked thoroughly. Only seven men were available for an operation that, according to the official disaster report, required about 40 men working in shifts. The rescuers worked in groups of three or four without adequate time for rest between shifts. The manager of Hamstead was permitted to join the explorers and wear rescue apparatus despite his lack of training. Finally, Jack Welsby, an Altofts man

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[110] Allott, "The Reopening of Norton Colliery."

[111] Redmayne, *Report on the Underground Fire at Hamstead Colliery*, pp. 5-7.

suffering from a cold, took part in the exploration. Using up his oxygen too quickly, he collapsed and died.[112] No survivors of the fire were found. In the pressure of the moment, Garforth had gambled, embarking upon a rescue in an unfamiliar colliery with inadequate resources. He later acknowledged that the Hamstead operation was hindered by the inadequacy of the rescue force.[113]

Instead of discrediting the mine rescue movement, the exploits of the teams from Altofts and Tankersley were portrayed in heroic terms by the media. At a dinner in their honour, the Lord Mayor of Birmingham presented gold medals and £25 each to the gallant rescuers, and funds were collected to support Mrs Welsby.[114] The lesson drawn by many observers was that the rescue network should be expanded to facilitate a quicker response. Alexander Smith, president of the South Staffordshire and Warwickshire Institute of Mining Engineers, called for action in his district: 'To argue that rescue-stations were unnecessary, was equivalent to saying that there was no need for fire-brigades, and that armies and navies were not wanted, because these were times of peace.'[115] A rescue station covering this area was opened at the University of Birmingham in 2010.[116]

The Cadeby Main disaster in 1912 attracted national attention because it coincided with the visit of the King and Queen to Doncaster.[117] The official report on the tragedy allows us to observe the behaviour of management during a mining

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[112] Redmayne, *Report on the Underground Fire at Hamstead Colliery,* pp. 10-17.

[113] Garforth, *Suggested Rules*, p. 42.

[114] "Mine Heroes." *Yorkshire Telegraph and Star*, 7 July 1908, p. 8.

[115] Anon, "Election of Officers 1908-1909," p. 97.

[116] Anney, "Death on the Warwickshire Coalfield," p. 306.

[117] Our Correspondents, "Pit Disaster in Yorkshire." *The Times*, 10 July 1912, p. 8.

emergency. Cadeby Main was a gassy colliery prone to spontaneous combustion. So-called gob fires had smouldered for six years. Management had fought a war of attrition to extinguish them, but the problem (which was far from unusual) recurred. A few days before the first explosion, the managing director, W.H. Chambers, gave the colliery manager, Charles Bury, instructions for building stoppings to prevent fresh air reaching the fire. Chambers then went to Sunderland on business. Bury did not follow the instructions accurately. Work on the stoppings continued in the presence of significant amounts of gas. The first rescue party after the initial explosion was led by a deputy, the most junior grade of mine official. It began exploring the colliery before Bury reached the scene. When Bury arrived he told the rescue party to begin collecting the dead and sending them to the surface. Several sets of breathing apparatus were available on site, but when no gas was encountered the sets were taken off. Other rescue parties, including members of H.M. Mines Inspectorate, were exploring when a second explosion occurred. Help had been requested from Wath rescue station after the first explosion, but it did not arrive until after the second one. The death toll was 35 in the first and 53 in the second explosion. The initial rescue operation had been piecemeal rather than planned, the type of panicked response that Garforth deprecated. The risk of a second explosion had been underestimated. Bury, who perished with three inspectors in the second explosion, should not have allocated resources to retrieving the dead. When Chambers returned from Sunderland, the stricken area was sealed to contain the afterdamp.[118]

[118] Redmayne, *Report on the Explosions at Cadeby Main Colliery*, pp. 9-23. Other disturbing aspects of the Cadeby disaster were debated in Parliament. *Hansard* HC Deb. 02 July 1913, vol 54, cc1972-99.

Several weeks later, men in breathing apparatus were sent beyond the stoppings to explore the damaged area, bring out the dead, and begin the work of recovery. On 18 August, a team from Manvers Main wearing Draeger apparatus was carrying a corpse out on a stretcher, when one member, James Burns, lost his mouthpiece, panicked, and was asphyxiated. Burns, aged 45, had no teeth and must have found it awkward to grip the mouthpiece at the best of times. The Wath station instructor acknowledged that Burns might have been unfit. The official report criticised the absence of clear instructions to the Manvers Main team. Lives should not have been risked in an area full of afterdamp merely to collect the dead. Such failures are suggestive of weak management at the colliery and the rescue station.[119] Work at Cadeby Main cost Wath rescue station £1756, a sum reimbursed by Denaby and Cadeby Main Collieries.[120] Notwithstanding the flop of rescue operations at Cadeby Main, the local media praised coalowners for funding a 'splendid' mine rescue service that was as well-equipped as any in the country.[121]

Finally, in 1913, a British miner was saved by rescuers using breathing apparatus. Albert Schofield, a miner at Lodge Mill Colliery near Huddersfield, was brought out alive by a rescue team from Altofts which had travelled to Huddersfield

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[119] Redmayne, *Report on the Explosions at Cadeby Main Colliery*, pp. 23-24; RALS, 185/B/9/1/1, Rotherham and District Rescue Station Board, Notes of a Visit to Wath Rescue Station on Wednesday, October 2nd 1912; SCA, COAL/Y2/5/8, Wath Joint Rescue Station, Record of Occurrences and Occasions on which Apparatus have been used, undated.

[120] SCA, COAL/Y2/1/1, Wath Rescue Station, Minutes, 4 October 1912.

[121] A.W.M. "Don Valley Notes," *Yorkshire Telegraph and Star*, 24 Sept. 1912, p. 4.

by motor car.[122] Incidents requiring a call out were infrequent. Between 1908 and 1933 the Wath rescue station was summoned to 20 emergencies. The most common incidents were underground fires, followed by gas or coal dust explosions. Rescue brigades also helped to deal with ventilation problems, outbursts of gas, floods, and repair and recovery work. Wath-trained rescue brigades were credited with saving four lives: two in a fire at Musgrave Colliery in 1914, and two gas victims at Manvers Main in 1916.[123] Tankersley was quieter, and its breathing apparatus was used in action just twice between 1914 and mid-1923.[124]

The mine rescue system offered coalowners and their workers an additional, if fragile, degree of insurance. Occasionally, however, that insurance proved decisive, most notably at Knockshinnoch Colliery, Ayrshire in 1950, when 116 miners trapped after a flood were saved by rescuers equipped with Proto apparatus.[125]

IX

Disaster management is a modern concept, but its principles may be observed in the UK coal industry in the early twentieth century. Heavy casualties from underground fires and gas and coal dust explosions ensured that the public was reminded on a regular basis of the dangers of mining. There was no consensus as to the best means of preventing the ignition of coal dust until after the outbreak of the First

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[122] Lloyd, “Use of Rescue-Apparatus at Lodge Mill Colliery.”

[123] SCA, COAL/Y2/5/8, Wath Joint Rescue Station, Record of Occurrences and Occasions on which Apparatus have been Used, other than Practices, since the Station was Opened in 1908, 11 September 1933.

[124] SCA, COAL/NC/10/6, Tankersley Joint Rescue Station, Occasions on Which Apparatus has been Used Underground, 28 July 1923.

[125] Bryan, *Accident at Knockshinnoch*.

World War. In the meantime, enhanced importance was attached to mine rescue measures, consisting of disaster preparedness and response. During the first decade of the twentieth century, some groups of collieries invested in central rescue stations, purchased sets of breathing apparatus, and trained miners in their use. Rescue teams equipped with breathing apparatus had a variety of roles, stretching from searching for trapped miners to extinguishing fires to recovering mines damaged by fire, explosion, or flood. By providing mine rescue facilities, employers insured themselves against bad publicity at a time of rising labour tension and public concern.

Yorkshire employers led the way, at least initially, opening the UK's first mine rescue stations in 1901 and 1902. After 1910, however, the government intervened to force coalowners across the UK to open rescue stations. Disaster management was a second-best answer to the dangers of fire and explosion. Prevention was more desirable, but even after the introduction of compulsory stone-dusting explosions could not be eliminated. The mine rescue system was attractive to many employers because it was inexpensive relative to the industry's overall costs. These costs were also shared by groups of collieries.

The main contribution of this article is to show that disaster management was taken seriously in at least one industry in the UK in the early twentieth century. A network of mine rescue stations, equipped with sets of sophisticated breathing apparatus, spread across British coalfields between 1900 and 1920, at first on the initiative of innovative coalowners, but later at the prompting of government. This article is also the first to utilise surviving mine rescue station archives. In addition, it shows how coalowners were able to cooperate at the local level on more than wages and labour problems. Disaster management, finally, is demonstrated to be an

unjustifiably neglected area of UK business history, one which deserves far more attention from researchers in future.

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