

WASC 2200

The Royal
Gunpowder Mills
Waltham Abbey
The Safety Record
with particular
reference to Explosions
of January and
April 1940

The Royal Gunpowder Mills, Waltham Abbey: Its Safety Record, with Particular Reference to the Explosions occurring in January and April, 1940

“As when a spark lights up a heap of nitrous powder, laid
Fit for the tun, some magazine to store,
Against a rumoured war, the smutty grain
With sudden blaze diffused, inflames the air.”¹

As a museum, the Royal Gunpowder Mills in Waltham Abbey opened their doors to the public on the 17 May, 2001, for the first time since their unlocking in the mid-1660's. This 'secret' site, which was home to gunpowder, explosive production and research until 1975, began life on lands occupied by a late medieval fulling mill,² and re-opened appropriately, with a fireworks display.³ Privately owned until 1787 when they were purchased by the Crown, by all accounts the Mills evolved into the paramount gunpowder works in Britain, the foremost in Europe and, in the early part of 1916 during World War I, they were the only government-owned explosive mills in existence.⁴

Although now located in the midst of 175 acres of natural parkland⁵ and housing twenty-one historic buildings, with their combination of unparalleled history, awesome science, and tragic, perhaps unnecessary deaths, their site would appear to have earlier been dangerously placed⁶, at times extending into Waltham Abbey's main thoroughfare.⁷ The surrounding area was originally a tiny hamlet, but one which already contained the historic Abbey of Waltham, popular with legions of pilgrims, visitors investigating its legends, royalty

¹ John Milton. *Paradise Lost*, Book 4, lines 814-818, in the *Norton Anthology of English Literature*, p.1891.

² Fulling was the process of finishing or cleansing woollens by scouring and beating.

³ *Forester* magazine, Issue 28, Spring, 2001, p.11, published by Epping Forest District Council.

⁴ Bryn Elliott, 'U.K. Gunpowder Factory Explosions', in magazine *After the Battle*, No.93, p.35.

⁵ Created by many years of neglect. The grounds surrounding the mills grew into a wilderness and became a habitat for all kinds of wildlife, in particular for herons.

⁶ Appendices 1 and 2. Map of the Mills as they are today (Internet: April, 2001) and part of the Mills taken from an earlier sketch found loose in W. Winters. *Centenary Memorial of the Royal Gunpowder Factory, Waltham Abbey*. Mapper unknown.

⁷ Highbridge Street, which leads directly to the door of the ancient Abbey itself, some 450 yards from the location of the old Saltpetre Refinery. By all accounts, the danger to the area and its inhabitants was finally recognized in 1943, and all explosive work removed to a safer uninhabited site in the wilds of Scotland.

and clerics alike.⁸ The Abbey Church had apparently been the biggest provider of employment for its local people until the emergence of the Gunpowder Mills in 1665; they gained momentum with the Crown 'takeover', the continued reinvention of gunpowder, and the development of more sophisticated plant and machinery. This is borne out by the population figures given in the Censuses covering 1801 to 1851 and a marginal note⁹, from which it will be seen that Waltham's population growth percent rose and fell with the advent and cessation of the Napoleonic and Crimean Wars.

Between the Mills' opening and their closure in 1975,¹⁰ regular explosions, some with fatalities, involving gunpowder, guncotton and, later, nitro-glycerine, littered their chequered career.¹¹ 71 men died in explosions and related accidents at Waltham Abbey over the 275 years in question, and although this would seem an abysmal record, if a comparison is made with, say, the government's later factory at Faversham, it is obvious that Waltham's Mills were more fortunate for, in one explosion alone at Faversham on 2 April, 1916, 108 people died and 64 were injured.¹² Earlier, near Paris, when the "Reign of Terror was in...full vigour",¹³ an astronomical 3,000 people died at a Gunpowder Mills establishment at Grenelle. Waltham's Mills, in spite of their colossal output during World War I when their employees numbered over 5,000, emerged practically unscathed in contrast, and continued to do so until the fateful year of 1940, when, ironically, both explosions which occurred were not due to the expected enemy bombs, but instead involved the notoriously unstable nitro-glycerine.

The attitude towards accidents during the initial period of gunpowder production appeared to be one of inevitability, and, as far as can be ascertained from the few early written

⁸ The history of the Abbey of Waltham goes back to Saxon times. Five churches have stood on the site. King Harold is supposedly buried in its grounds, and the Abbey at one time allegedly housed a 'miraculous' cross.

⁹ Appendices 3 and 4.

¹⁰ Although vacated in 1943, they were taken over by the government's Research and Development Section, considered slightly less dangerous to the surrounding area than explosives manufacture.

¹¹ Appendix 5. List of recorded deaths covering the period of the Gunpowder Mills' existence.

¹² A. Percival, *The Great Explosion at Faversham, 2nd April, 1916*, p.32.

¹³ W. Winters, *Historical Notices of the Royal Gunpowder Works, Waltham Abbey*, p.44.

records available¹⁴, little attempt was made to analyse causes, or initiate measures of prevention. This may of course have been due to early lack of scientific understanding of the fundamental causes of explosions and/or to the volatile nature of gunpowder. Measures were introduced in 1793¹⁵, however, to improve what few regulations were already in place.¹⁶ For instance, orders start appearing in the factory records to the effect that “no beer was to be drunk” at the Mills, “no dogs” should be admitted¹⁷, and gravel, which had been found “at the bottom of a shoe” owned by a worker, could be avoided by regular inspection of footwear. The men were thereafter stopped a day’s pay for not obeying orders regarding dirty soles. On 27 February hard flint was discovered on press and corning-frame sieves, although instructions had been given that covers should always be in place to avoid this occurrence. All of these guidelines indicate, perhaps, a lack of concern or knowledge within the labour-force, an illustration of workers possibly not ‘thinking on their feet’.

While traverses limiting explosion damage were also first introduced in the late 1780’s,¹⁸ and later, blast walls came into existence, nevertheless, accidents invariably continued, diminished or otherwise. For instance, at the time of the Napoleonic wars, the factory was “working under considerable pressure”, and the millmen were found to be

¹⁴ Prior to the introduction of dependable information from the Explosives Inspectorate in 1885. The Inspectorate had come into being following the 1875 Explosives Act, but did not produce reliable figures until some ten years later. Many descriptions and figures were obtained prior to 1875 from those recorded in the Parish Burial Registers, and parish magazines by various local historians.

¹⁵ W. Simmons, *A Short History of the Royal Gunpowder Factory at Waltham Abbey*, Ch.X1, p.65.

¹⁶ *Ibid*, Ch.X1, pp. 65-76. Government orders and factory reports are cited, but no references are included; neither were these found at the P.R.O., Kew. Access was denied to the Royal Gunpowder Mills’ records now held at its Museum because, although they had been returned from the printers in readiness for the Museum’s opening, they had not yet been sorted. Therefore, corroboration was not available. Moreover, because of the national epidemic of foot and mouth disease occurring early in 2001, access to all buildings was denied for the reason that visitors could contaminate the wild deer and other wild life present.

¹⁷ It was presumed that dogs would also carry grit in their paws, proving fatal if inadvertently mixed with powder during any stage of its progress.

¹⁸ ‘R. Coleman’s Minute Book’ in W. Winters. *Historical Notes of The Royal Gunpowder Works*, p.39. Mr. Coleman, the Clerk of the Mills, stated that traverses were “a very excellent invention.” However, according to “The Archaeology of Safety” in the *Royal Commission on Historical Monuments of England*, 1993, p.158, the use of solid traverses (part brick and part earthwork) was puzzling, because by the turn of the century it was known that solid traverses were a hazard; their collapse, of course, resulted in massive amounts of heavy, flying wreckage killing and injuring workers.

increasing the mill charge of their own accord to meet production,¹⁹ to which “several explosions” and “great injury were ascribed.”²⁰ In turn, this resulted in Major Sir William Congreve,²¹ directing the mill charges to be reduced. It appeared, therefore, that safety regulations were materializing after rather than before accidents occurred, but it could be argued that perhaps preventative methods of protection which should have been in force were not yet widely available in this hazardous industry; additionally, the workforce repeatedly exhibited symptoms of self-destruction, seemingly contributing a good deal toward the vulnerability to which the industry was prone. For instance, many entries included in Mr. Winters' book consist of records of fines and dismissals for drunkenness, murder, brawling, stealing, having nailed and/or dirty shoes, etc., and falling asleep on, or not turning up for, watches.²²

By the last third of the nineteenth century, Waltham's Mills expanded in line with Britain as both spread their boundaries wider, Britain unfurling her flag and protecting her Empire by strength of arms and the Mills buying up more land in order ultimately to supply that demand for arms. Two new explosives, guncotton and nitro-glycerine, appeared on the market, and in 1891 cordite was introduced. According to Simmons, however, it was only in 1857 after

¹⁹ According to the Mills' Museum's brochure, between 1793 and 1814 (the French Revolutionary and Napoleonic Wars), gunpowder production at Waltham's Mills rose from 5,000 to 25,000 barrels a year.

²⁰ Simmons, op.cit. p.66. According to Norman Paul, a retired ex-scientist employee of the R.G.M., 42 lbs. of green powder was the standard amount which went into the incorporating mill. A mill charge was the mixture of three ingredients including green powder, ground and blended together, then wetted down. It was then dried and incorporated for four hours in an incorporating press (the most dangerous process of all), pressed hard between copper sheets, and the resultant product granulated through sieves. This produced two types of powder, the finest being used for rifle charges and the remaining larger particles for canon charges. Mistakenly, the millmen considered that by introducing 84lbs. instead of the standard 42lbs. of green powder into the initial process, they were increasing production, but in fact what they actually did was to make the whole process twice as dangerous. It was only later discovered that larger machines than those used at the time could facilitate an increase in the standard measure of green powder, thereby finally increasing production, but, at the time, Major Congreve reduced even the standard from 42 to 38lbs.

²¹ Major Sir William Congreve (1772-1828) was Comptroller of the Royal Laboratory, but carried out a great many of his researches at Waltham. In 1805, Major Congreve invented the Congreve Rocket, first used in the Napoleonic Wars. According to Wayne Cocroft in *Dangerous Energy*, p.33, he “bridged the gap between experimenter and manufacturer, which had earlier been a distinction of social class as well as function.”

²² W. Winters. *Historical Notices of the Royal Gunpowder Works*, pp.37-75. 'R. Coleman's Minute Book, 1793-1796'.

numerous severe accidents that "it seems to have been the beginning of the realization that explosions might be preventable."²³ Nevertheless, an explosion on 27 May, 1861 "showed...that a great deal of laxity and carelessness still prevailed." Following another explosion in 1870, Sir Frederick Abel,²⁴ in the course of giving expert evidence at the coroner's inquest, said, "However careful men are, it is impossible for these explosions to be guarded against", but in the years following, significant efforts were made to explicate the cause of all explosions and, therefore, to challenge Sir Frederick's remarks. During an 1864 inquest reference was made to safety clothing; the coroner remarked that in the 1861 explosion, "the men's clothing was saturated with gunpowder and took fire very rapidly".²⁵ He was convinced that the fireproof clothing (lasting cloth²⁶) worn in the 1864 explosion had saved all parts of one worker's body being burnt, except for his face and hands.

Some precautionary measures, therefore, had now been introduced, rather than there being wisdom after the occurrence, and according to Simmons, "both the public and the official conscience were beginning to revolt against the idea that accidental explosions were natural and inevitable."²⁷ After a particularly severe accident in 1893, Simmons says that the newspapers, national and local, were "critical of the state of affairs in the factory."²⁸ The inquest was not straightforward, and the jury strongly demanded that safety factors should be communicated to the Home Office. Moreover, pertinent questions were apparently asked in the House of Commons, suggesting that the Factory, being government-controlled, was not complying with the safety regulations provided in the 1875 Explosives Act,²⁹ as were private

²³ Simmons, *op.cit.* pp.68-70.

²⁴ Sir Frederick Abel, scientist and chemist to the War Department and Ordnance Committees (1854-88). He applied himself to the science of explosive and was, with Sir James Dewar, the inventor of cordite. He also introduced a new method of making guncotton and invented the Abel tester which determined the flash-point of petroleum.

²⁵ Simmons, *op.cit.* p.69.

²⁶ Appendix VI. A durable cloth, added to which were bone buttons to which powder did not adhere. Later gauntlets and a cloth helmet were added. Cocroft's *Dangerous Energy*, p.100.

²⁷ Simmons, *op.cit.* p.69.

²⁸ *Ibid.* p.71.

²⁹ *Ibid.* pp.68-70.

manufactories of gunpowder. The reply given was that according to section 97 of that Act, government factories were exempt from the Act's provisions. An official enquiry was opened, presided over by Lord Sandhurst and other noteworthies in the field.³⁰ Their report was apparently unfavourable, crucially concluding with important plans for future safety, and considered to be the cornerstone of modern safety practices within the explosives industry. In addition, in 1895 the Metropolitan Police Office issued revised Police Orders³¹ regarding the practice of smoking in the mills, to the effect that no matches, "or means for procuring a light", pipes or tobacco - carried "either in their hands or in their clothing" – were to be allowed.

Perhaps due entirely to these earlier recommendations, the 38 years from 15 December, 1902, until 18 January, 1940, proved a quiet period with few mishaps for the Mills at Waltham Abbey. However, in January and April of 1940,³² two serious detonations occurred, both with loss of life, although safety regulations of some sort had been in place for over 150 years. In an effort to determine, if possible, whether management/and or workforce carelessness or complacency had played their part, conditions surrounding the two detonations will be examined in this essay.

January, 1940, was by all accounts one of the coldest ever recorded. Production was at full tilt following the scaling down between the First and Second World Wars. According to one newspaper, shortly after 10.30 on the morning of 18 January, *three* explosions occurred at the Mills killing five men and injuring others. The newspaper cited an eyewitness who said he had been carrying a bag of guncotton near the building in which the first explosion had occurred, and had he dropped it, not only would he "have been blown to pieces," but "there would have been nothing left of the district."³³ Another newspaper stated there were *two*

³⁰ Lord Sandhurst was Parliamentary Under-Secretary of State for War. Under him for this Enquiry were Sir Frederick Abel, the Chief Inspector of Explosives and the Deputy Adjutant-General of the Royal Artillery. They were far from being 'yes-men' and the Enquiry was full and elaborate.

³¹ Appendix VII. (With Middlesex University, Tottenham Campus).

³² 6,000 and 3,800 lbs. of nitro-glycerine and guncotton exploded respectively.

³³ The nitro-glycerine stored in the huts adjacent to where he was standing would also have exploded.

“terrific explosions at 10.45 a.m., in which five men were killed and about 30 injured³⁴. It becomes immediately apparent that there were differences of observation regarding both the time and the actual number of explosions which took place, and that newspapers, which historians regard as primary sources, are, nevertheless, sometimes unreliable. Both newspapers were agreed, however, that it was the worst explosion in nearly 40 years. At the Walthamstow inquest, the coroner heard that the two victims found were recognizable only by their identification disks, and the inquest was adjourned because a search was still in progress for “remains of the other three victims.”³⁵

Speculation in all the newspapers and rumours amongst the townspeople ranged from sabotage to carelessness.³⁶ Other inferences were that because of the war there was a lack of skilled manpower to run the delicate routines and dangerous practices within the factory. Be that as it may, at 5.00 p.m. on the day of the explosion, a secret Court of Inquiry³⁷ investigating the circumstances “attending an Explosion at the Royal Gunpowder Factory” was held. The conclusions reached were that the probable origin of the explosion “was No.14 stove”, that the time of the explosion was “10.42.30 and 2 seconds precisely”, (which was deduced from evidence based on the seismograph record obtained from the Kew Observatory), and that

The unnamed eyewitness's account was “reprinted from *The Daily Telegraph*.” (no date) by the *War Illustrated*, and featured in their 2 February, 1940, edition, p.60, under the title ‘Carried Gun-cotton at Waltham Abbey.

³⁴ The *Enfield Gazette & Observer*, 26 January, 1940.

³⁵ This information was gleaned from all newspapers. On applying to the Walthamstow Coroner's Court, and thereafter to the London Metropolitan Museum where inquest records are kept, I was told that all Reports are closed for 75 years, and therefore those for the two explosions requested would not be available until the year 2015.

³⁶ The *Enfield Weekly Herald & Enfield Highway and Ponders End Advertiser*, 26 January, 1940, among many other newspapers, stated that Inspector Salisbury of Scotland Yard, aided by War Office officials and heads of the factory departments, were continuing to question workmen. Police inquiries had taken place during the previous weeks and would continue, but they appeared unable to supply evidence of sabotage.

³⁷ Numbered 262/83(7) and held by order of the Director of Ordnance Factories, it was sent to the Chief Superintendent of Ordnance Factories at the Royal Arsenal, S.E.18, by Lt. Co. J.C.E. Pellereau, O.B.E., President of the Ordnance Factories. The Court of Enquiry comprised Mr. H. A. Phillips from the D.O.F., Ministry of Supply, Col. J. S. Mellor, O.B.E., M.C., the Chief Constable, M.I.5.P., Capt. A. S. T. Godfrey from the War Office, R. P. Evans, the Superintendent of the Royal Ordnance Factories and Dr. T. Barratt and Mr. E. Garratt of the Research Department. In attendance was Dr. H. E. Watts, M.B.E., His Majesty's Inspector of Explosives.

“Guncotton, which was known to be of good stability, would be unlikely to ignite spontaneously.” Other causes considered were sabotage, the possibility of which could not be entirely excluded, and the weather; the Court strongly favoured the last cause, the presence of frozen nitro-glycerine being regarded as possible, due to the intense cold.³⁸ Additionally, included as possible causes were errors of judgement on the part of operatives who had never before seen frozen nitro-glycerine, and faulty procedure on the part of the boat transport which originally carried the explosive, because it allowed a delay in the nitro-glycerine’s passage “with its consequent long exposure to cold in winter time”. The Board discarded the theory of impure ingredients because “evidence shows that the ingredients were up to Specification.” The official verdict reverted to the old chestnut ‘cause unknown’.

A long list of recommendations was included, which hinted at carelessness or negligence occurring by those responsible for the Mills. For instance, “Measures should be introduced to ensure the quick boat transit of Nitro-glycerine poured on Guncotton and Paste at all times, with no boat being allowed to make intermediate calls on its journey”³⁹, and “should the air temperature outside fall below freezing point, selected responsible officials should have the duty of warning all workers to be on their guard against frozen nitro-glycerine”. ‘Special Rules’ were to be posted and their intention made clear and understandable to operatives; “thus a short explanation of the nature of frozen Nitro-glycerine or Paste would assist them in identifying it and in taking the action laid down in the Rules.”⁴⁰ In addition, observations were made to the effect that because there were thermometers at both ground and wall level in all rooms at the Mills, there was a possibility that while the wall thermometer registered the

³⁸ Experiments were carried out by the Research Department which showed that “a mixture of liquid and frozen nitro-glycerine was more sensitive than isolated frozen nitro-glycerine”.

³⁹ There is no mention of *where* these barges were making ‘intermediate calls’ or *why* they did not go from ‘A’ to ‘B’ in a straight line, considering the dangerous cargo they were holding.

⁴⁰ These remarks suggest that the workforce had not been trained, and, therefore, were not experienced enough to spot frozen nitro-glycerine that could occur on its ‘open-to-the-weather’ journey.

specified temperature,⁴¹ the temperature of the ground level thermometer might give a different reading and so should also be checked, that because “the rapid expansion in production from the abnormally low peace rate...resulted in a great scarcity of trained staff which seriously handicapped the proper training of operatives”, the Court desired to “invite attention to the need for maintaining a nucleus of trained and skilled staff in peace time”, and that immediate consideration should now be given to “the training of additional staffs.”⁴² The Board could find no fault with the “very satisfactory layout of the factory”,⁴³ which no doubt saved further loss of life, nor with the general “conduct of the staff and operatives and the well drawn up General Rules”. All of the foregoing, however, could be condensed into the facts that no operatives had been trained to know what frozen Nitro-glycerine looked like, the weather was inclement, the boat carrying the nitro-glycerine was an open barge which made other calls on its journey (which in turn had possibly caused the substance to freeze), and the previously posted Rules were either not fully understood, or were ignored by the workforce.

The second major explosion during 1940 occurred at 9.14 a.m. on 20 April, again in the nitro-glycerine sector; once more, five men were killed and fifteen injured, six of them seriously. According to the official enquiry⁴⁴ and the local newspaper reports, nothing remained of three of the men apart from a fragment of one skull. Recognizable remains of the other two men, both ‘Hillmen’,⁴⁵ were found floating in a nearby aqueduct, some 18 yards from the seat of the blast. The centre of this explosion occurred in No. 2 Paste Mixing House [*sic*], one of the many buildings replaced after being totally destroyed in the previous blast, and the “counterpart” to that which had generated the January series of explosions. The official report

⁴¹ All work was to cease if the temperature dropped to 10 degrees centigrade.

⁴² All of these recommendations appeared to confirm the inferences made by the newspapers but were not necessarily carried out. (See discussion on second explosion).

⁴³ Large areas of space were insisted upon between mixing houses and other essential but dangerous buildings.

⁴⁴ Numbered E5/753. (P.R.O.) Dated 20 April, 1940, at 3.00 p.m. The composition of the Board was similar to that of the 18 January, with the exception that in addition, two shop stewards had been included, along with D.I. Scurr of the Metropolitan Police, who had been working on security in the factory.

⁴⁵ Hillmen were responsible for carrying empty and refilled bottles of nitro-glycerine back and forth from the production source to the test laboratories.

on this accident recommended that, "after being wrecked twice in a year, No. 2 Mixing House was to be abandoned and rebuilt on a different site."⁴⁶ Proposals can be found in both Reports with regard to quality and experience of staff, which some three months later still seemed to be lacking. The Inspector of Danger Buildings giving evidence said that although he did not think there had been an "intentional reduction in discipline", nevertheless, "there was a tendency amongst the men to contravene the rules",⁴⁷ and the Superintendent of the Mills⁴⁸ told the Court that "our labour at the moment is appalling." In addition, although Danger Building Visitors had been increased from four to six since the previous explosion, they were excluded from the Mixing Houses.⁴⁹ Consequently, their method of inspecting the Mixing Houses was to view the work in progress through the windows.

Sabotage was again suspected and again ruled out⁵⁰, and, once more, foreign bodies introduced were considered as a possible cause, and again dismissed⁵¹. Although evidently bitterly cold at night, the daytime temperature that April was warm, and the Board was of the opinion that the weather was not the cause. Instead, after an investigation during which 18 witness were called, possible blame was laid at the door of Chargeman Keene, one of the workers inside No. 2 Mixing House, who was thought likely to have dropped a sample bottle of nitro-glycerine while carrying it to the area provided for deposit and collection by a Hillman, in

⁴⁶ Numbered 262/83(7). This recommendation appears to contradict the January findings, in which it was stated that the Board could find nothing wrong with the "very satisfactory layout of the factory".

⁴⁷ April Report, p.7.

⁴⁸ Mr. P. G. Knapman.

⁴⁹ D.B.V.'s, as they were called, were employed to inspect buildings where dangerous practices were carried out. For some reason (undiscovered) they did not enter buildings where protective socks had to be worn. However, if the risks involved required workers to wear socks, it would, surely, have been logical that this dangerous type of building needed to be inspected by D.B.V.'s more thoroughly than others.

⁵⁰ D.I.Scurr in his statement (p.14) seemingly laid to rest what were, in his opinion, "the unfounded reports" of sabotage which between January and April had started to reappear in the newspapers, although on page 6 of the Board's Report it is stated "there can be no doubt that sabotage is not impossible."

⁵¹ Report of 20 April, 1940, p.3. Six possible causes in all were examined, i.e., sabotage, faulty procedure, presence of foreign bodies, condition of plant, impure ingredients and acceleration of output; all were dismissed, some with reservations.

this particular case, either Mr. Raby or Mr. Monk.⁵² Some of the witnesses told the Court that they had ascertained the direction of the blast, and, therefore, the seat, from the location of the remains of the two Hillmen found in the canal and minute remnants of a shattered sample bottle found near the debris which had been No. 2 Mixing House.

These two tragic incidents occurred during the Second World War when a good deal of the country's labour force would have been conscripted. From both Reports, it was evident that experts in the fields required in gunpowder manufacture were in short supply, as were experts to train the workforce. However, January and April of 1940 were early days in the war, and it is wondered if every expert in this field had been conscripted or had volunteered for active service. Britain learned its lesson half way through the First World War, bringing in conscription as late as 1916, when it was desperately short of men. Therefore, re-instigating conscription in May of 1939 seemed, perhaps, eminently sensible. However, the manufacture of explosives was surely of the utmost importance to the war effort, and the Mills were government-run. It is strange, therefore, that the vital safety aspect of trained staff in this establishment appears to have been ignored.

Additionally, in both cases, the board did not appear to investigate fully the introduction of foreign bodies into the dangerous substances used in the Mills, intentionally in the case of smoking, or unintentionally in the case of dirt, grit and the build up of dust from guncotton in many areas⁵³. While researching these two particular accidents, articles in local newspapers nearly every week during 1940⁵⁴ reported cases of men taking into the Mills "matches" and "pieces of wood", sometimes in the lining of jackets. Instantly dismissed, and imprisoned if they did not have the money for the fines imposed, the perpetrator often pleaded he did not

⁵² In a porch outside No. 2 Mixing House. Glass bottle samples were brought by a Hillman to this porch, deposited, and after being emptied by a chargeman, were wiped with a flannel, refilled with samples of the nitro-glycerine being worked on at the time, and returned full to the porch for laboratory testing.

⁵³ In the first Report, Chargeman Stone, who normally worked in the original No. 2 Mixing House, stated that "the condition of the Guncotton dust on the Mixing House floor" was known to be quarter of an inch thick. This could have been sparked at any time. (Not spontaneously, however).

⁵⁴ For example, *The Weekly Telegraph for Waltham Abbey, Cheshunt, & Districts*, 8 March, 1940, p.8. Col.3. Appendix VIII.

know "how these things got there". Stringent and successful though most of the searches were, it is conceivable that some employees may have escaped detection, inadvertently causing accidents.⁵⁵ The workforce must have felt the pressure in such a hazardous occupation and doubly so under war conditions, perhaps, feeling that surreptitious smoking in the open air could not have harmed. It was stated in the second Report that in hot weather, doors to the Dangerous Buildings were left open, with Gun-cotton dust and grit wafting in and out; therefore, it is conceivable that smoking could have inadvertently 'sparked' accidents; in view of the hundreds of cases brought to Court every year, it is felt this feature should have been investigated more fully, although not necessarily in relation to either of these two accidents.

It cannot be denied that investigations into these two explosions appear to have been carried out in depth and with some integrity; the Board obviously attempted to enquire into every possible method of improving already existent safety factors. Nevertheless, what does become apparent from these two Reports is that matters fell short of perfection on the part of the Board, because it did not appear to have instigated any form of checking procedure to ensure that the original recommendations on 20 January in relation to inexperienced workers and lack of training, had actually been carried out.

To summarize, to decide whether these two accidents were inevitable or avoidable is an impossible task, with or without expertise. Even with the required knowledge, it would be difficult, particularly in the case of the second blast; dead men, of course can neither defend themselves or offer alternative explanations. It is felt however, that given the state of the workforce in 1940, i.e., many were young, unaware, under-trained and possibly complacent,

⁵⁵ Although notices around the Mills regarding smoking and prohibition of matches were prolific, the workforce, not having encountered an accident for nearly 40 years, appeared to have become complacent and taken risks. While this is conjecture, in Appendix VIII it will be seen that the Bench considered the three men in this particular instance were endangering the lives of their fellow-workers. All three had taken in boxes of matches and denied knowledge of them, one having said that "I searched myself and thought I was safe." Excuses included that of someone else planting the matches.

one must come down on the side of inevitability. Nevertheless, the Board, mostly government employees and officials, appeared at times, and for whatever reason, not to be able to 'follow through' recommendations made three months earlier.⁵⁶ It must be remembered that these two Inquiries were set up only hours after each explosion had occurred; many of the people giving evidence would, therefore, have been suffering from loss, distress and shock and perhaps not be able to articulate as clearly as they should. Whatever known or unknown factors may have been thought responsible, from the top to the bottom of the chain of accountability, human beings were involved, and 'to err is human'.

It is safe to say that in cases involving the weather or death, no complete answer will ever be found, but this rather begs the question. The weather, perhaps, has been held accountable far too often, and Chargeman Keene could not defend himself or offer an alternative explanation. Although possibly avoidable, both accidents could, paradoxically, also be regarded as inevitable.

⁵⁶ In the Report of 20th April, further proposals on the benefits of using rubber-covered sample bottles were put forward, but whether those proposals were carried out, has been difficult to verify because the gunpowder and nitro-glycerine production transferred to Scotland in 1943.

Notes

Although time did not allow investigation into the aspect of compensation awarded to dependents of the deceased, it was noted from papers held at the Public Records Office and the newspapers read, that in most cases adequate (for 1940) and sometimes, generous, compensation was given by the government. In addition many charity functions were held by the public in Waltham Abbey and surrounding districts to aid the unfortunate dependents.

Although two trips were made to the Royal Gunpowder Mills' Museum in order to read and copy the few documents available at the time, even though a full visit was repeatedly requested, it was not granted because the official opening by the Duke of Gloucester was delayed until 17 May, 2000, and it would have taken someone four hours to have taken me around the site. The visit made to the Imperial War Museum was interesting, but only for the 'feel' of what conditions were like in the Mills in 1940. While there, two paintings by employees of the Mills were viewed, and two interviews were listened to of recipients of medals for bravery at the Mills, which also added colour to the project.

Poignant was the visit made to the local cemetery. From the Addenda included, it will be seen that the deceased were only given headstones to their graves some 58 years after the events, and were finally laid to rest with a Memorial Service which took place on 20 April, 1998; it was the Memorial Service which triggered my initial interest.

Addenda

Pictorial and self-explanatory coverage of the Memorial Service
held 58 years later
to commemorate six of the ten victims who died in the 1940 explosions.

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