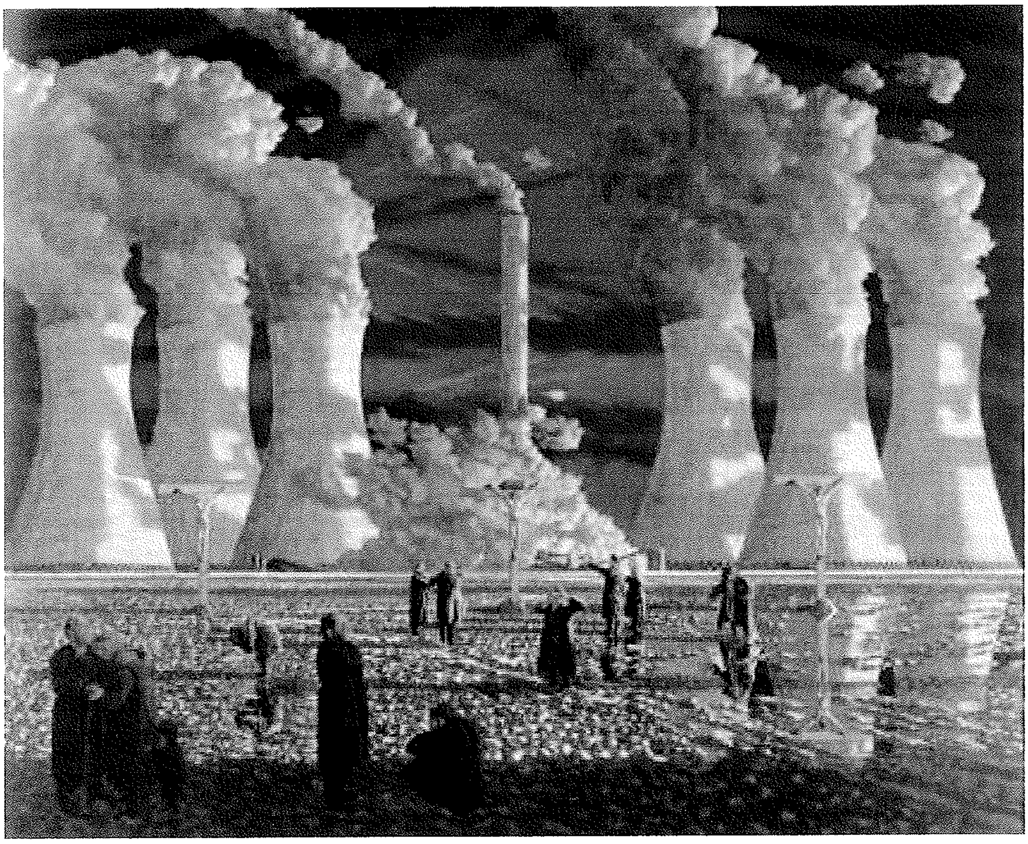
A REQUEST FOR A CERTIFICATE OF IMMUNITY AGAINST LISTING: DIDCOT A POWER STATION, OXFORDSHIRE

A background report



REPORT 1

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A CERTIFICATE OF IMMUNITY REPORT FOR DIDCOT A POWER STATION

Context

A request for a Certificate of Immunity against Listing for Didcot A Power Station, Oxfordshire, was received from CgMs Consultancy by English Heritage in July 2012. CgMs applied in the form of a detailed statement with a photographic survey, on behalf of the owners, RWE npower.

Background

Power stations of the 1960s

This was a period when Central Electricity Generating Board (CEGB) aimed to bring a series of 500MW unit power stations on-stream. The building of most power stations was expected to take five years to complete, and in some cases, up to seven years.

Eleven major coal-fired power stations were released for construction in the early part of that period. Chronologically these were: West Burton, Ferrybridge C, Eggborough, Kingsnorth, Fawley, Ironbridge B, Fiddlers Ferry , Ratcliffe, Cottam, Rugeley B, and Didcot A. Currently, there are fourteen coal-fired power stations in operation: Cottam, Didcot A , Drax, Eggborough, Ferrybridge, Fiddlers Ferry, Ironbridge B, Kingsnorth, Lynemouth, Ratcliffe- on-Soar, Rugely B, Tilbury B, West Burton , ICI Wilton. These have a total of 67 cooling towers between them.

The Cooling tower: its history, architecture, structure and function.

Cooling towers allow the dissipation of heat generated in the process of making power, into the atmosphere. Before the 1920s, they were made of timber with a life expectancy of 15 years only; steel cooling towers had an even shorter life expectancy because of corrosion. In the early Twentieth century, developments in reinforced concrete became a natural choice of material for this kind of structure.

In the 60s particularly, the towers became part of a whole design *ensemble* - the towers, power station buildings and landscape – and considerable care was taken to ensure that this was achieved sensitively.

The basic components of a 1960s power station are those found at Didcot. A coal supply delivered to the site by a dedicated rail loop and either stockpiled or taken by conveyor to a Boiler house. The coal is ground finely in a pulverising mill and blown into a boiler to burn like gas. Within the boiler, the heat produced converts the feed water into steam. For greater efficiency, steam is passed through the boiler twice. Steam passes into each turbine turning the blades and shaft. It is then returned to the boilers for reheating and subsequently back to the turbines through four, reduced pressure stages. The spent steam from the turbine exhaust enters a condenser, turning into water as it passes over tubes containing cold water from an adjacent river source. The condensate is returned, for reuse, to the boiler. The warmed river water emerging from the condenser is then passed to the cooling towers.

The distinctive, hyperbolic-curve shaped, natural draught cooling tower was invented by a director of the Dutch State Mines, Professor F.K.T. van Iterson, with civil engineer G. Kuypers, both working in the Netherlands during World War I. The design was patented in 1917.

L.G. Mouchel & Partners provided the UK with its first natural draught, hyperboloid, and reinforced concrete cooling towers. They introduced the distinctive shape with which we are now so familiar, albeit small and squat when compared with more standardised towers of the last 40-50 years. L.G. Mouchel & Partners' senior engineer T.J. Guerritte persuaded the Liverpool City Engineers to consider the new material, as pioneered by van Iterson and Kuypers. Guerritte was successful and the firm was appointed to design the towers, eventually providing 12 for the site in 1925. The success of the towers at Lister Drive, Liverpool led to the appointment of L.G. Mouchel & Partners for towers at Wolverhampton Power Station and Hams Hall Power Station in Birmingham also in 1925, and Coventry Power Station in 1927. L.G. Mouchel & Partners dominated the market, building 157 in the UK alone.[1]

The Lister Drive towers were 39.6metres high and 30.5metres in diameter at the base. The hyperbolic shape is efficient since it allows the steel reinforcing bars in the concrete to be straight, though sloping. The sides of each tower were 3.68 metres thick at the base, decreasing progressively to 1.65 metres at the top. Holes at ground level allowed the passage of air, a 'natural draught'. The small size of the towers allowed a capacity of only 825,000 gallons an hour. The Lister Drive cooling towers remained in service for 40 years and were demolished in 1965

In November, 1965, three of the cooling towers at Ferrybridge Power station in Yorkshire collapsed, due to vibrations caused by 85 mph winds; they were destroyed. The three towers were rebuilt and the rest strengthened to withstand any future adverse weather conditions. As a result of this incident, the condition of cooling towers was monitored closely and a British Standard was introduced for future design and construction.

The function of a cooling tower, as it suggests, is to cool the exhaust vapour of the generating turbines with water and to return the water to the nearby river from which it was originally drawn. In operation, water is piped into the lower part of the tower and then via a complex network of pipes or troughs ending with sprinkler devices. A fine mist of water is sprayed on a lattice of staging and screening filling the lower 4-5 metres of the tower, with water being cooled by natural evaporation assisted by air being drawn upwards through the tower.

DIDCOT POWER STATION

Choice of Site

The choice of a possible power station site is limited by conditions which are important enough to justify placing intrusive industrial plant into a rural environment - in the case of the proposed Didcot Power Station into a relatively unspoilt valley landscape. The requirements were for a centre of electricity demand, good railway communication for coal delivery, nearby source of water for cooling, and a site of considerable size and topographically flat.

The area chosen for the 2000 MW coal-fired power station was on the eastern part of the 370 acre site of the former Ministry of Defence Central Ordnance Depot, near the town of Didcot. The following factors were used to determine the location: This site was close to the towns of both Oxford and Reading and therefore a centre of electricity demand in central southern England. It was situated alongside a main railway which gave easy access to coal from the East Midland coalfields. The nearby River Thames was a reliable source of water for the cooling process. The 204 acres of the site were ideal for the industrial development of a power station - the land was flat, with large ranges of stores and sheds at the end of their useful life, and all services were on site, including railway sidings.

The principle objection was that it was situated in the Thames Valley and was overlooked to the east by the Chiltern Hills and to the south by the Berkshire Downs. This area of considerable natural landscape value was much appreciated by the surrounding village communities, and in particular Sutton Courtenay was heavily opposed to the development. However, a local vote was taken and although the opposition was strong, those for the proposal of a power station on that site carried the final vote by reason of the potential number of construction jobs that would be created.

The functional layout design and landscaping of the site

The commissioning board, Central Electricity Generating Board (CEGB) chose Frederick Gibberd and Partners to design a functional layout for Didcot Power station. The remit included creating an optimum landscaping solution to reduce visual massing and maintain the wide, views across the valley. Gibberd commented that he appreciated CEGB's 'willingness to spend money on this intangible thing called aesthetics'.[2] The practice worked together with the consulting engineers, C.S. Allott and Son. Building was started in 1965, completed in 1968 and finally commissioned in the same year.

The basic, functional layout (Drawing A) was to consist of a coal store directly supplied from the main railway line; a turbine hall, bunker bay and boiler house to be built as a single integrated unit linked to a chimney stack 199.5 metres tall; eight hyperboloid cooling towers (114.3 metres(375 feet high) in serried ranks were proposed. The final layout and design evolved over a considerable period and embodied optimising the requirements of a functional plant, architecture, landscape architecture and cost. The main building unit was placed at the centre of the design equidistant between the two groups of cooling towers and as widely spaced as possible.

Frederick Gibberd saw the landscape problem as one in which the relationship of the station to the valley views needed to be tested in order to determine the effects of a functional layout on the surrounding environment and to inform an optimum aesthetic vision. He tested three types of view: distant hill views, since they affect the region as a whole, valley views from surrounding roads and local views particularly those from local villages. The power station, together with the eight cooling towers, would be a massive intrusion into the landscape and visible from along the Berkshire Downs and the Chilterns as far as the Aylesbury Gap.

A visual study of differing heights and combinations of towers were considered to see whether those between 375 feet and 250 feet high or in either groups of eight or twelve improved the effect on the landscape. The collapse of the Ferrybridge Towers in 1965 precluded any exception to the standard height. The groupings when viewed from four different vantage points were then investigated: Gore Hill, south -west of the site, Crowmarsh Road east of site, Wittenham Clumps east of the site and Abingdon lying north of the site. When grouped as two parallel rows of four, the massing was formidable from the north and when formed into two groups of four they were seen to be less so but visibly impacted from the Chiltern Hills and Wittenham Clumps. The final solution (Drawing B) approved by CEGB was one in which the towers ignored the rectangular arrangement of the power station components. They were reduced to a total of six in two groups of three and placed diagonally at either end of the NW-SE axis across the site.

Views of the power station vary considerably as one moves around the valley; the chimney acts as a fulcrum around which the towers appear to move and change in number and scale, merging with each other or the main building(Drawing C). This study enabled appreciably improved views in the gaps between the towers, from both the Chiltern Hills and from the length of the Berkshire Downs. In considering the optimum landscaping for the site, Gibberd decided that as the area was a rather flat valley, great mounds of earth would be unsuitable to screen the buildings. He devised 'earth hedges' to screen the coal yard from the main railway and security fence and proposed to retain most of the mature trees on site, but also plant new ones , in the form of copses to screen the buildings from the access roads(Drawing D).[3] There is an original Gibberd drawing, entitled Landscape studies (2) signed FG July 1964, which substantiates both his final design and un-questionable role as the architect and landscape architect for Didcot Power Station (a digital copy is held by Assessment Team South, EH).[4] The rectangular layout of buildings and roads created a functional and geometric simplicity which influenced his choice of rectangular tree groupings as opposed to the asymmetric siting of the cooling towers.[5]

Gibberd also used a similar design at Sizewell A nuclear power Station in Suffolk, where he extended a block of woodland to screen part of the site.

Colour

Gibberd did not consider using colour for the exterior of the cooling towers or any of the power station buildings at Didcot. He wanted 'to create an even grey tone over the whole composition': the cooling towers being as naturally grey as the chimney and the plant a similar grey tone. He considered a warm cream and biscuit plus white at ground level and the only possible colour contrast a dark, deep green. He described colour patches and picking out pieces of mechanism as 'too arty, too trivial, too mannered and too inconsequential'.[6]

Frankland Dark, the architect of Drakelow C Power Station, Burton - on - Trent, chose a warm, red colouring for two of the cooling towers, in order to bring them forward visually, from the four grey towers. Factors such as different seasons, local climate changes and mental associations of colours seen through seasonal changes were also considered. At Drakelow, the choice was effective on clear days, but on cloudy days all were enveloped in a grey dimness.[7]

The architect of Ironbridge B Power Station at Buildwas in Shropshire, Alan Clark, worked closely with landscape architect, Kenneth Booth, to ensure that the station, on the banks of the River Severn, merged into its natural surroundings of wooded hills and appeared hidden when viewed from Ironbridge. The cooling towers were constructed using cement to which a red pigment was added. The effect was to blend with the colour of the local soil and they cannot be seen from The Iron Bridge, Grade II listed. These impressive measures contributed to the creation of a power station which became an asset to the Gorge and was short-listed for the Royal Institute of Chartered Surveyors/ The Times Conservation award in 1973.[8]

The power station at West Burton, Nottinghamshire was built for the Midlands Region of CEGB and commissioned in 1965. The architects were the Architects' Design Group and the civil engineering consultants Merz and McLellan. It was regarded as innovative in relation to its 2000 MW output, size (it encompassed a 500 acre site) and use of colour. It also claimed records with its annual consumption of 5 million tons of coal and production of 1 million tons of ash.[9]

The use of colour at West Burton had two purposes: the principal purpose was to prevent the coalescence of the main structures and cooling towers when seen under conditions of heat haze or poor visibility from half a mile away or more – massing together and blurring of the individual structure outlines significantly increased the apparent bulk of the whole site- and, it was acknowledged, gave rise to considerable public opposition. The Trent Valley has climatic conditions that could cause the 'lozenge 'group of eight cooling towers to be seen as one large mass for most of the year. The solution was to reduce this massing tendency: one pair of towers was constructed using dark grey cement giving a tonal contrast to the adjacent towers of Portland cement; the main boiler and turbine house were treated similarly, with large areas of contrasting black and white sheeting on adjacent sides of the buildings.

The second use was to create a point of reference (cf. Gibberd's fulcrum at Didcot) within the whole building complex which would be visible from viewpoints around the station and from which the relevant positions of all the elements, one to another, could be easily judged. The most northerly tower, slightly offset and divided from the remaining line group by the conveyor rising to the boiler house gable, seemed the most obvious point of reference to be taken. The tower was built of coloured cement using a colour closely matching the dull yellow, number 4-057 in the British Standard Colour Range 2660. The tower, which can be seen at considerable distances and under poor light conditions, is successful in its function as a nodal point for the entire complex. The same colour has been used on the side walls of the crusher, and also for the ends of the triangular trusses, above the black cladding of the turbine house, which are seen clearly against the glazing of the boiler house. The black cladding and the dark grey tower act as a distinct and contrasting back drop for the white, precast aggregate cladding of the rectangular control building[10]

At Rugeley A and B Power stations in Staffordshire, Architects, Watson and Coates and Landscape architects Colvin and Moggeridge were appointed. Nine cooling towers were constructed, one larger than the rest as an experimental 'dry' tower, two were coloured a deep, peat brown and the rest constructed in the normal cement.

The visual perception of industrial buildings and the planting of non-operational space

The grounds of Drakelow Power Station were planted around the main buildings for landscape value, but included both woodland and pasture. Nature walks have become popular with local schools; encouragement of interest in wildlife broadens the appreciation of landscape conservation.

Isolated structures in remote places can contribute to the impressiveness/grandeur of the scene. Colvin (1970) suggests that care for the effect of buildings on their environment – at least an acknowledgement of man's place in nature, responsibility to the land and the future –is needed. Shapes of structures in relation to the ground contours creates a certain effect and on the direct simplicity of that relationship. The plants serve as a screen for inevitable clutter that accumulates on the ground around buildings. When considering massive buildings, high chimneys and towers, tree and shrub planting can give firm, horizontal lines to balance their height yet simultaneously concealing lower ground facilities. For example, car parks, and roadways, if seen from outside the site, destroy the simplicity of a group. The main structures are best set off on strong horizontal base of vegetation undisturbed by clutter.[11]

CEGB had a policy to employ landscape architects for both nuclear and conventional power stations Frederick Gibberd was also appointed Landscape architect for Hinckley Point A nuclear power station in Somerset, Sizewell A, Suffolk and later Hartlepool, County Durham. The latter was planned in 1967, construction started in 1969 and it was completed in 1985.

Brenda Colvin(1897-1981),a noted public, landscape architect in the post-war years also took delight in accepting private garden commissions ,a major one being The Manor House ,Sutton Courteney [12] for David Astor in 1945.The latter is of interest ,since Colvin was to refer to the Manor House and its views of the power station in her 'Criticism' of Didcot Power station(1974).Colvin worked on the landscape of a number of power stations. Four schemes of the sixties period are listed in her notebook: Drakelow 1959(no.432), Eggborough 1961(no.454), Rugeley 1962 (no.490) and Meadford 1966(no.506).[13]

For Drakelow C, the third and largest power station to be built there, Colvin presented CEGB with a report which considered the whole Drakelow site in relation to its surrounding landscape and views from roads in a wide rural area. She was optimistic and felt the site could become 'a fine landscape of the future'. The 1962 landscape proposal plan shows pre-existing and proposed woodland and a nature reserve in gravel workings.[14] Her plan of Eggborough shows clearly her landscaping concepts. She describes her use of trees planted on soil banks to screen both the coal store and railway where both were sited low and inside the banks, in order for the screening to be effective from the start.[15] At Rugely A& B, Colvin designed shelter belt- planting along one longitudinal aspect and incorporated a number of existing trees.

Colvin, together with Sylvia Crowe, represented objectors against certain aspects of the siting of the Didcot Power station at the inquiry. The power line was aligned eastwards to avoid the Goring Gap and it was agreed that there was a need for an underground length. In 1945, Colvin had been involved in the private garden commission for the Manor House in Sutton Courteney. When built, the Didcot cooling towers were visible from the grounds and she received a request to screen them with trees. Colvin felt they were a significant feature of the landscape - 'giant eye-catchers' - and that the view of them should be retained. It was.

However, professionally she admired the success of Gibberd' s landscape design for Didcot which followed ideas which she had promoted and put into practice, for example at Drakelow. His landscape treatment had, she felt, 'the merit of great simplicity'. The trees balanced the scale of the towers and provided a foil to their mechanical shape without any attempt to screen them from view. The rectangular blocks of forest trees are placed with careful regard to either the need for screening or opening up views between the structures. Her only criticism was that perhaps the vegetation should have had 'a more sinuous flow' thus relating the concrete structures more decisively to each other. Until the trees reach full maturity, the open gaps seemed too wide particularly when viewed from the north-east.

Operational History and description of plant at Didcot A

CEGB was privatised in 1990 and for the next ten years the site was operated by National Power. It became part of Innogy (who also began the construction of a gas-fired station Didcot B adjacent to Didcot A, in 1990s) for the period 2000-2002, prior to the takeover of Innogy by RWE npower in 2002.The Didcot Power Station is still in operation, but as an opted-out station under the Large Combustion Plant Directive (LCPD). RWE npower announced on 18 September, 2012 that Didcot A plant would stop operating on 31 March 2013. Following this date, RWE wish to start a six-month decommissioning phase in late 2013. They have already received interest from 20 demolition contractors and consider October, 2013, the earliest possible date to commence demolition.

The site layout is rectangular in outline, but with cooling towers in distinctive groups of three at either end of its NW-SE axis. The principal units for the power process are the integrated Boiler and Turbine housing, which also include the pulverising mills and condensers; externally, there are four generator transformers, a pentagonal control room, six cooling towers, four electrostatic precipitators, to assist in the reduction of fly-ash from the flue gases before entering the atmosphere via a four-flued chimney, and an administration block.

Gibberd describes the various forms and material treatment of the buildings which were discussed at CEGB briefing meetings and agreed in partnership with the civil engineers and himself. His involvement as architect and landscape architect is again substantiated by minutes of these meetings, personally initialled signed or numbered drawings of buildings and landscaping[16] and the unedited copy of an article later published (Gibberd, 1974).[17]

Each of the six cooling towers at Didcot Power Station was constructed for CEGB by Film Cooling Towers Ltd, to cool 9,000,000 gallons of water per hour from an input temperature of 32.1 degrees C to the outlet of 23.6 degrees C. To achieve this, it is sprayed over packing where hot water and cold air meet at the base of each tower. The packing was made up of Baltic Redwood timber slats, impregnated with arsenic. These currently remain only in N2 cooling tower and are apparently replaced when rotten; discarded, narrow, triangular- shaped slats could be seen in a nearby skip. The remaining tower slats have been replaced with plastic, which rest on precast concrete columns and beams with asbestos cement louvres above to catch any water droplets carried upwards. This enables over 1,000,000 gallons to be evaporated each day from the six towers when the four 500MW generators are running.[18] This process creates the water vapour plume seen emerging from the top of the towers.

The turbine shafts are linked to each generator unit, where electricity is produced at 23,500 volts AC. However, to enable transmission across the National Grid System, the voltage is increased to 40,000 volts via each of the four generator transformers located to the north of the turbine hall.

Currently, it operates flexibly as a dual-fired power station, three of its four 500 MW generating units being able to burn either natural gas or coal. It is the first major UK power station to do so. In addition, a biomass/coal blending facility was built in 2003 to enable the replacement of up to 2% of coal that the station burns, with a low carbon, renewable source (forestry and agricultural biomass products).

The architect and power engineering

Are items such as power stations and their surroundings designed to be replaceable? Yes, but much architecture in the past has been designed to be irreplaceable and some is still with us. The temple -like buildings of the 20s and 30s far outlasted the thirty years of their originally installed plant; more expendable structures were characteristic of the 50s and 60s power station programme (Beaver Committee, 1952). If a power station is located, for example, opposite St Pauls Cathedral e.g. Bankside or in the middle of a rural landscape, e.g. Didcot, controversy arises in that a seemingly irreplaceable scene or object is being threatened by an irresistible force. A further difference is the degree of a building's attachment to land; buildings not only exhibit earth materials - bricks, mortar, concrete and natural timber which grows out of the ground and its contours - they are consciously designed for their setting and become identified with it.

Description of Ironbridge B and Comparison

The history of electricity generation at Ironbridge A and B bears witness to the fact that Ironbridge has played a pioneering role in the age of electricity. Ironbridge A was built in 1929, commissioned in 1932 and closed as an operating station in 1983. The two stations co-existed for over a decade, which served to highlight the contrasts in design between them. There was great fondness for Ironbridge A; it was nick-named the 'Queen Mary' with reference to its three steel stacks, boilers, turbines, a bridge-like control room from which supervisors issued instructions via a telegraph and great pride was taken in its polished brassware and cleanliness(cf .the dirt and dereliction of the nearby ironworks and coalmines). Thirty years ago, work began on power station B to satisfy a dramatic spurt in demand (doubling every eight years) which emerged during the boom years of the 1960s. There was confidence in modern technology and architecture.

Great care and expense was applied to designing and landscaping Ironbridge B in deference to the lush, rural setting of river meadows close to the River Severn and the surrounding by an arc of hills from the Wrekin to Wenlock Edge. The station emerged as 'a structural framework that rose above the norm for post-war power station architecture and remarkably sympathetic to the dramatic backdrop of the Ironbridge Gorge.'

Clark and Booth worked closely together using the basic composition of Eggborough, commissioned in 1967. The compact, ribbon -like site necessitated the realignment of the component units and the need to reconcile the bold outlines of steel and concrete with the surrounding landscape of fields and woodland hills. Booth had become increasingly interested in the challenge of modern mega-structures, such as power stations and oil refineries. Crowe commented that it was impossible to conceal such huge forms; it was better to exploit the 'new and exciting range of shapes' using natural landforms to envelop them and soften their influence upon the surrounding countryside.[19]

Clark and Booth rose to this challenge; they reduced the clutter of ancillary buildings and allowed angular and arching forms to create a strong silhouette against the sky. Clark opted for a sweeping arc arrangement for the four towers, in order to make the best use of the narrow plateau behind the railway line and to obscure, at least partially, the towers from the Gorge

As with Didcot and the CEGB meetings, the Ironbridge B design also evolved over some time through meetings involving a model, and several visits to surrounding landscape viewpoints above and across the Severn Valley. The meetings took place in Sheffield at the offices of civil engineers, Sir Percy Thomas & Son, also involved at Eggborough. Particular attention was given to the visual impact of Ironbridge B as viewed from the west; trees were planted near Leighton and Cressage to prevent undue visual intrusion to those travelling on the north or south sides of the Severn valley.

Sir Frederick Gibberd's involvement as both Architect and Landscape Architect in the design and site layout of Didcot A Power Station

In February 1964, at a Briefing Meeting of the proposed Didcot Power Station, the Planning Department of CEGB invited Frederick Gibberd to accept the appointment both of Executive Architect and of Landscape Architect for the project.[20] CEGB produced a model of the layout No. 9A (Midlands Regional Group) and Gibberd commented that from an architectural point of view the topographical position of Didcot made it a difficult site to deal with. At this same meeting, Gibberd expressed a concern about the number and mass of the cooling towers and asked for consideration of a reduction in number and his preference was for six standard towers (375feet);he did not advocate a mixed - height group nor a group of twelve, smaller 250 foot towers. He used the model to demonstrate the spacing of two groups of three towers with the main station buildings placed between them. His handwritten notes of this meeting concur with the actual Minutes.

Comments made by Sir Howard Colvin (2007), relating to a meeting to discuss the Didcot design is supported by the fact that designs for new power stations had to be presented to the Royal Fine Art Commission for comment and advice, before they were approved .[21]

The Report of the parliamentary Power Station Committee (1953) produced a series of recommendations, in relation to consideration of power station development, siting and design, one of which was the desirability of a periodic review every five years.

Aesthetic relationships

The power station and, in particular, its cooling towers have been a dominant feature of the skyline since the 1970s. There are those who think that they are a blot on the landscape but there are also those who regard them as iconic architectural or sculptural forms as evidenced by visually inspired painting, poetry and film.

The writer, Germaine Greer described them as 'fabulous creatures' and 'art objects' that deserve to be preserved [22]and the campaigner, Tom Keeley, fought to save the 'salt and pepper pots', as the Tinsley Towers were locally known. In 2008, he watched as the floodlit towers were demolished at night and was moved to comment that 'for their last gasp they looked really beautiful'.[23]

There is evidence of Didcot Power station connections with well- known architect, sculptor and artist members of the Royal Fine Art Commission in the 1960s. As a matter of CEGB policy, Power station designs were always taken to the Royal Fine Art Commission for approval. In an interview with Jeremy Musson (2007), Sir Howard Colvin, revealed the involvement of himself and his colleagues Henry Moore, John Piper, Raymond Erith, and Frederick Gibberd at a particular meeting of the Royal Fine Art Commission in the mid -1960s, in which they were presented with scale models to consider an optimum position for the six, Didcot cooling towers. They considered the possible positions which would reduce visual massing and yet be aesthetically pleasing within the surrounding landscape. He commented, ' I remember we were shown scale models of the cooling towers for Didcot power station and Henry Moore spent ages moving them around to create a good composition. I saw them the other day from the train and think he did a rather good job'.[24]

An ecclesiastical painting, Menorah by Roger Wagner (see frontispiece), was acquired by the Ashmolean Museum, Oxford in 2009. In 2010, it formed the centre piece of an exhibition of 23 paintings by Wagner, illustrating his translation of the Book of Psalms. After the exhibition, Menorah returned to St. Giles Church, Oxford on permanent loan. [25] It is an extremely powerful Twentieth century painting of Christ's crucifixion set against the cooling towers of Didcot Power Station, Oxfordshire. Theresa Thompson considered it to be a 'synthesis of the moving and the motionless, of symmetry and geometry, beauty and ugliness, hope and despair, as well as stark industrial power and human vulnerability '. It combines memories, history, knowledge and religious beliefs. It depicts a fusion of Jewish and Christian symbols, the six massive cooling towers and the chimney, belching out steam and smoke respectively, become the seven - branched ceremonial Jewish candlestick, the menorah. [26]

The Didcot Towers have also been the inspiration for poetry and music: Sir John Betjeman (1966)to write 'Impossible Progress' [27]; Sir Tim Rice to write the lyric 'Ode to Didcot Power Station' for the musical 'Three More Men in a Boat' in 1982. Kit Wright(2005) to write his 'Ode to Didcot Power Station' [28]; and John Elinger (2009), writing under an assumed name(actually Sir Christopher Ball, a retired Oxford don, a former Warden of Keble College and former Chancellor of the University of Derby) , won a national poetry prize for his lyrical poem, The Cooling Towers at Didcot. [29]

The myths and realities of the Swinging Sixties provided a history and a portrait of that era and a book, *Art and the sixties: this was tomorrow,* accompanied an exhibition of the same name at Tate Britain. It explores the blurring of boundaries within art of the time, and its evolving relationships with other cultural forms. The work of artists, for example, David Hockney, Bridget Riley, Richard Hamilton, Peter Blake, David Bailey, Colin Self, Eduardo Paolozzi, and Allan Jones is examined alongside developments in the media, photography, popular culture, architecture and advertising. In 1958, figures as diverse as John Betjeman, who lived near Didcot and was obviously familiar with the power station and its cooling towers, was an influential member of the Victorian Society. He commented on the fact that the new architecture was beginning to intrude and cause a loss of skyline. [30]

The BBC created a series of short documentary films relating to Building History, one of which was, a short cultural and visionary appreciation, produced by Marina Warner and entitled Didcot Power Station, 1970 (BBC Elstree,1990). Alcan Lynmouth Power Station, sited on the Northumbrian coast, has featured in two films shot locally – Seacoal made by Amber Films in 1985 and more famously, Billy Elliott (2000)directed by Stephen Daldry .The power station and aluminium smelter both feature as an industrial backdrop in the cemetery scenes and the coal-sorting area is used to represent a colliery. However, the power station does not feature cooling towers. The remaining towers and chimney of Richborough, Kent were used as a set, eleven years after de-commissioning, for the film Son of Rambow in 2007.

Designation assessment related to cooling towers

History: two recent assessments for the listing of cooling towers

In 2007, the cooling towers of Willington A and B electricity generating stations, South Derbyshire were assessed for listing.[31]Similarly, the Tinsley cooling towers of the former Blackburn Meadow electricity generating station, Sheffield, South Yorkshire were assessed separately, for listing in 2006 and scheduling in 2008.[32]

Willington cooling towers were components of two power stations developed between 1954 and 1960 and power generation continued on the site until March 1998. The coal-powered stations were a significant part of the post- World War II development of the National Grid; they were served by a total of five cooling towers which received water from the nearby River Trent. The designs for station A were developed by the consulting engineers Ewbank and Partners who managed its construction and commissioning and 2 towers were built in this first phase. The three cooling towers for Station B were built in the second phase and set at right angles, to the north of the original pair. Closure of the site began in 1993: Station A closed in May, 1995 and generating station B was closed in March 1999; demolition began in the same year and was completed by the end of 2003, except for the five cooling towers which are still standing to this day. The towers are 300 ft. high with diameters of 145 ft. at the top.

They were not considered listable for the principal reasons, ' that they are the only surviving components of two power stations developed in the early 1960s and thus their operational context as part of a power generating complex is lost; they are part of a large number of surviving cooling towers in England, mostly dating to 1960s and not rare in a national context; not distinctive structurally or technically being based on the earliest European designs of the 1930s; and the towers themselves are now incomplete, having been stripped of their internal cooling equipment.'

Willington Towers are likely to be demolished to make way for a new power station[33], Willington C. This is intended to have significantly less visual impact than the former Willington A and B and the existing cooling towers. It will consider the use of colour, location, height and be supported by an appropriate landscaping scheme.

The Tinsley Towers, Sheffield were the main surviving features of the former Blackburn Meadows electricity generating station built in the late 1930s to serve the needs of the 20th century steel industry, particularly the electric arc melting. They were not demolished with the rest of the plant in the 1970s because of their proximity to the Tinsley Viaduct carrying the M1 motorway. However, strengthening work to the viaduct, prompted the owners to plan to demolish the towers at the end of August, 2008.

They were considered by English Heritage (EH), both in 2006 and 2008, when it was concluded that 'they remain visible reminders of power generation in the vicinity, but are not in themselves of sufficient interest to justify designation or scheduling.'

They were the earliest, but highly fragmentary survival of the pre-nationalisation power generation industry. The rest of the station had been lost, depriving the towers of their functional context, and the loss of the pipe work, staging, screens and access ways seriously diminished their interest as the earliest, surviving hyperbolic cooling towers.

Designation assessment summary

The following bullet points are related to the evidential, historical, aesthetic and communal EH conservation principles, when considering designation assessment

- **28** examples with cooling towers survive of the 1960s period.
- Didcot cooling towers have not lost the associated power generating station of which they are a part and are adjacent to a further, more recent operating Station Didcot B. They have not lost their internal equipment which demonstrates the industrial process which they serve
- Didcot has the unique feature of two groups of 3 cooling towers specifically arranged to optimise the landscape views and landscaping
- Evidence of Frederick Gibberd's involvement in the development of the site layout, position and design of buildings at Didcot.
- Evidence of Frederick Gibberd's landscape design and Brenda Colvin's positive comment on the Didcot design of landscaping ,and her support in retaining view of towers from Sutton Courtenay Manor; support and admiration for the way in which the towers have been eased into the landscape; and the support of Sylvia Crowe for the design - all notable people in their professions.
- Ironbridge B is adjacent to World Heritage Site of Ironbridge
- Ironbridge B has four cooling towers intact and operational, arranged in an arc.
- Ironbridge B has cooling towers coloured by red pigment to blend with local soil/geology.
- The buildings of Ironbridge B are architecturally of the Modern Movement, Architect Alan Clark, metal and glass cladding and shapes are distinct and in cube-like proportions.
- Ironbridge is an historic site for the generation of electricity – pioneering role.
- There remains one building, probably the former Pump House of Ironbridge A, which is interesting architecturally but no longer in use.

- Ironbridge A and B are not listed (EH recommendation a few years ago).
- CEGB were committed to the architectural quality of its power stations and the preservation of amenity (see Electricity Act ,1957)

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APPENDIX 1

ENGLAND. POWER STATION COOLING TOWERS. 1960s

	Towers	Date			Architect /L. Architect/ Engineer	NOTES
Towers demolished		*Built*	*Commission.*	*Demolished*		
Agecroft	4			1994		
Calder Hall, Sellafield	4			2007		
Chapel Cross, Annan	4			2007		
Drakelow C	2	1961-63		2006	Frankland Dark ,Brenda Colvin	De-commissioned 2003
High Marnham, Notts	5			2012		
Richborough	3			2012		
Thorpe Marsh	6		1963	2012		4 cooling towers still standing
Tinsley Towers, Sheffield	2		1938	2008		
Total	*30*					
Towers remaining						
Cottam	8	1964-70			York,Rosenberg & Mardell, K & P Booth, Balfour Beatty	8 cooling towers arranged in a in rectangular form
Didcot A,Oxon	6	1965-70	1970	prop. 2013	Gibberd and CS Allott	2 groups of three; complete and functional; electricity for 2M; main chimney one of tallest in UK
Drax, N Yorkshire	12	1967-71			Clifford,Tee & Gale, Arnold Weddle,WS Atkins	2 groups of six arranged in a rectangular form
Eggborough	8	1962-70	1967		Sir Percy Hollis and Son (George Hooper), B Colvin	8 arranged in rectangular shape shape
Ferrybridge C	8	1961-67			Building Design Partnership, CS Allott	8 in lozenge shape
Fiddlers Ferry		1967-71			Architects' Design Group	8 in two lozenge shapes
Ironbridge B	4	1963-8	1969	prop. 2015	Alan Clark, Kenneth Booth,Sir Percy Thomas & son	complete and functional; proposed closure by 2015; arc of 4 towers
Rugely B	4	1964-70			LK Watson & L J Coates	Four in lozenge shape
Ratcliffe- on -Soar, Notts	8	1963-67	1968		Building Design Group/CS Allott	Modern Movement; distinct office block façade
West Burton	8	1961-68	1967-8		Architects' Design Group, Merz & McLellan	8 in two sets of four
Willington	5					Planning consent 2011 for new power generation plant; gas line required
Total	*71*					
Hartlepool		1968	1974		Frederick Gibberd & Partners,Merz & McLellan,Taylor Woodrow Construction	Nuclear;gas-cooled reactors
Hinkley Point B					Frederick Gibberd & Partners,	Nuclear;gas-cooled reactors
Sizewell						Nuclear;gas-cooled reactors

APPENDIX 2. Figures 2-10: Photographs taken by the author on a joint site visit to Didcot 27 September 2012. The group included RWE npower, CgMs, English Heritage Designation and Heritage Protection.

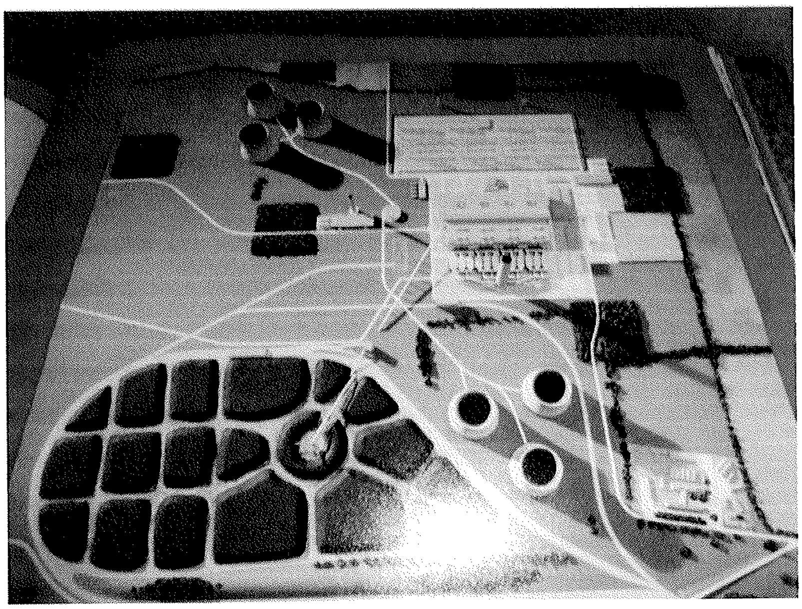


Figure 1. Photograph of the model of the Didcot site to Gibberd's design. Note the north-west – south-east axis plan with two groups of three cooling towers with chimney almost equidistant between. There are indications of an earth hedge to screen the coal storage area and seven rectangular copses of new trees of (Gibberd's House Archives)

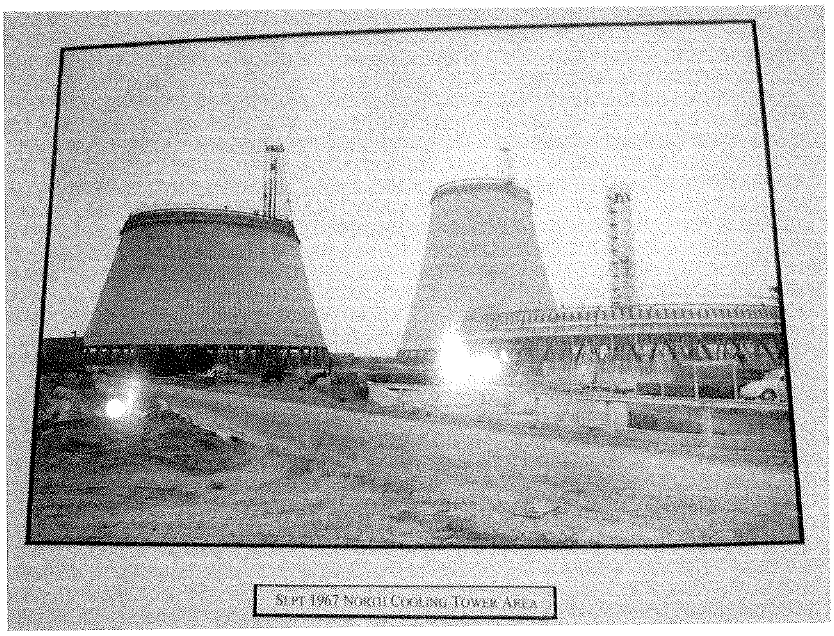


Figure2. North cooling tower area, September, 1967. Towers at different stages of incomplete build with supporting piloti clearly visible (RWE npower photograph).

Figure3 .Southern cooling towers in 1968.Note the different stages of the build, the free-standing 650 ft .chimney, turbine hall and ancillary buildings (RWE npower photograph).

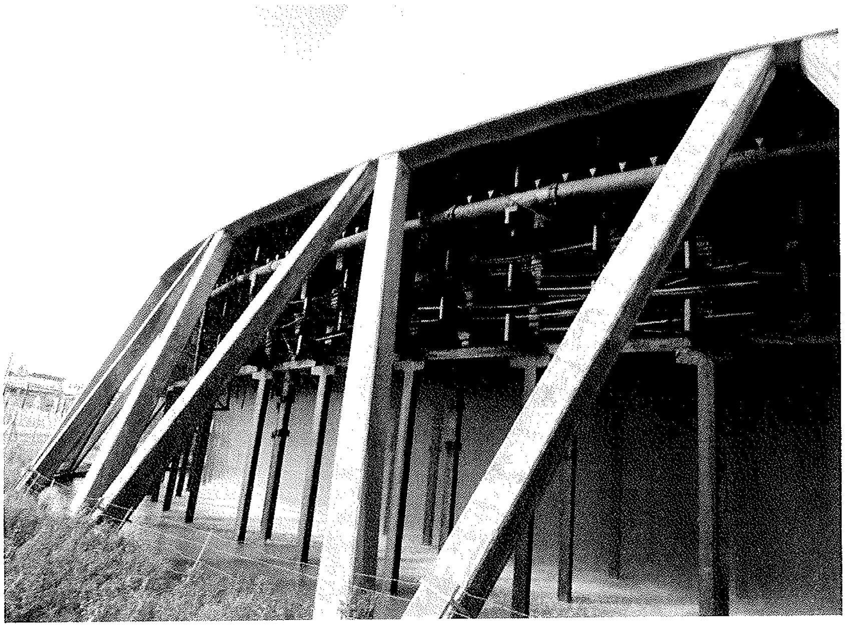


Figure4. Base of tower with inner diffusing system: pre-cast concrete columns and beams supporting a lattice of slats acting as direction diffusers

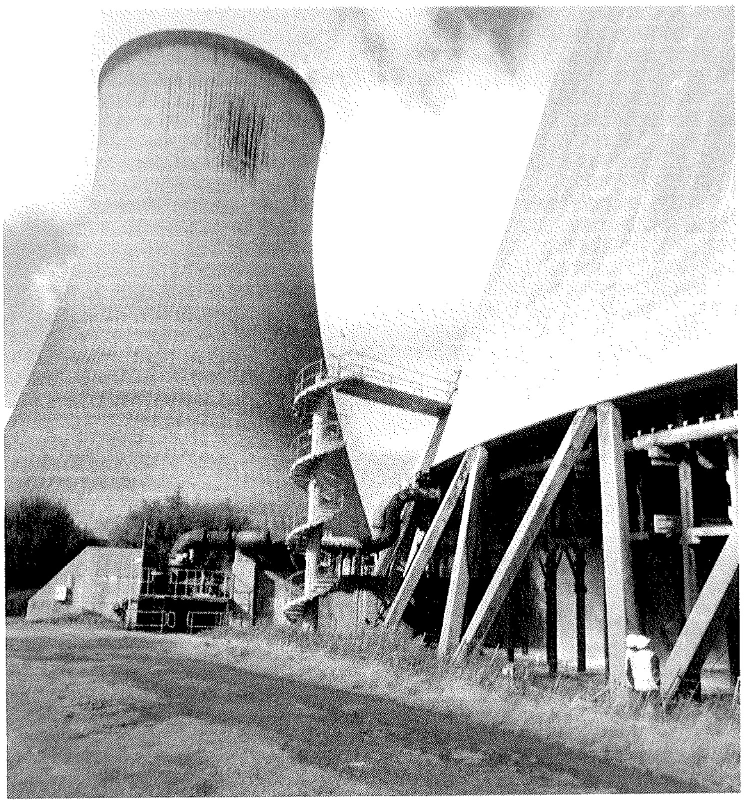


Figure 5. North 2 tower to the left: the only tower retaining Baltic redwood timber slats, which are replaced when rotten. The slats have been replaced with plastic in the five remaining towers.

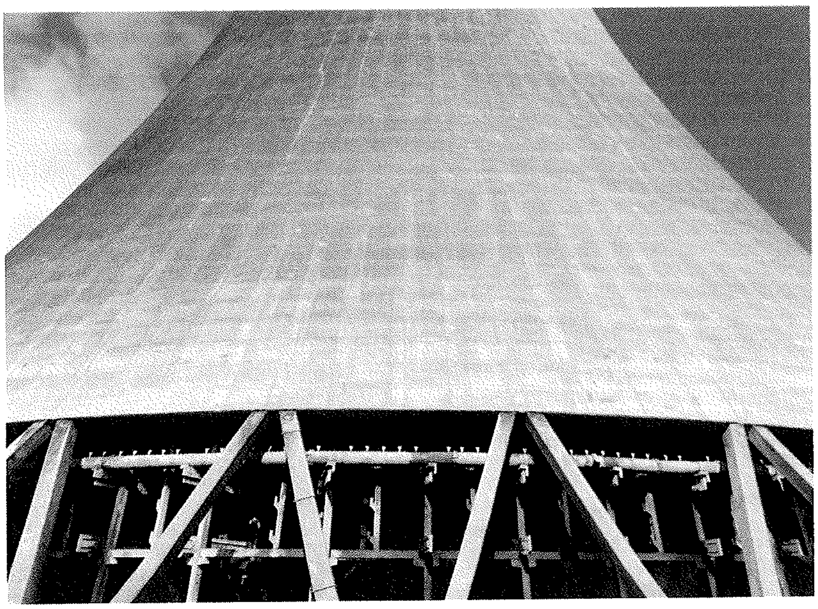
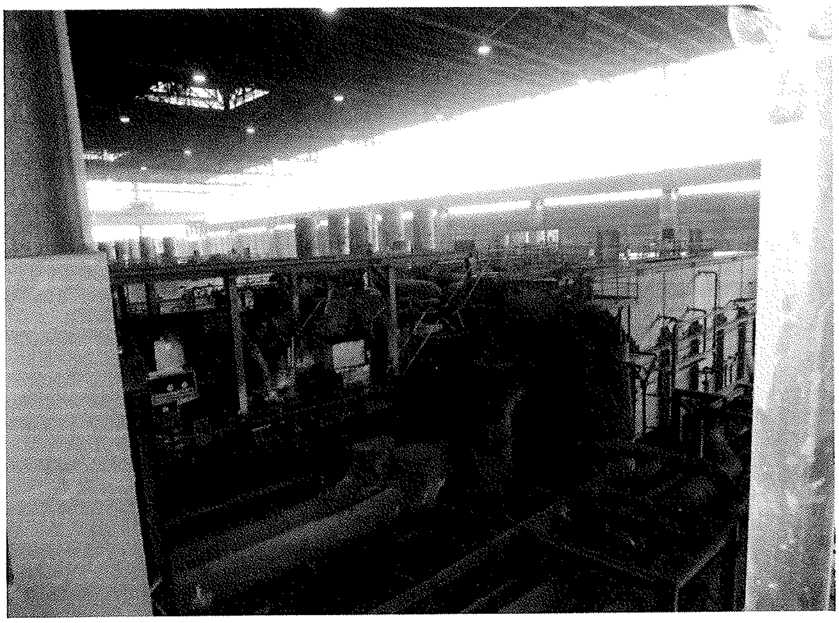


Figure 6. Cooling tower showing the shuttered concrete hyperbolic form supported by piloti

Figure 7. The integrated turbine hall, boiler house and bunker bay, all clad in grey ribbed aluminium sheeting. Note projecting glazed unit with five tiers of glazed units, above continuous patent glazed units in eight tiers.

Figure 8. Inside the turbine hall



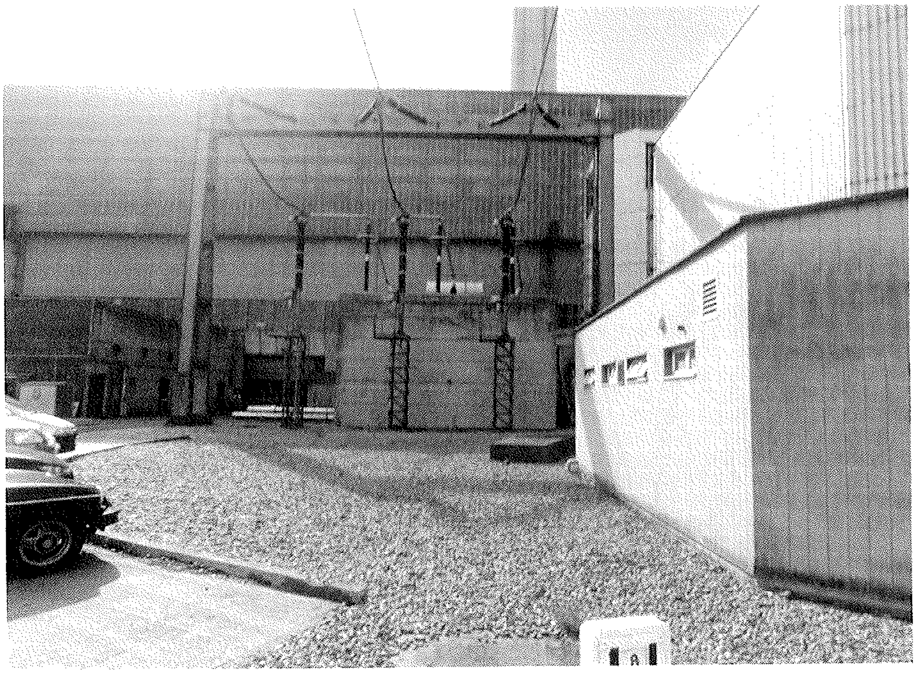


Figure 9. One of four transformers to the north of the turbine hall

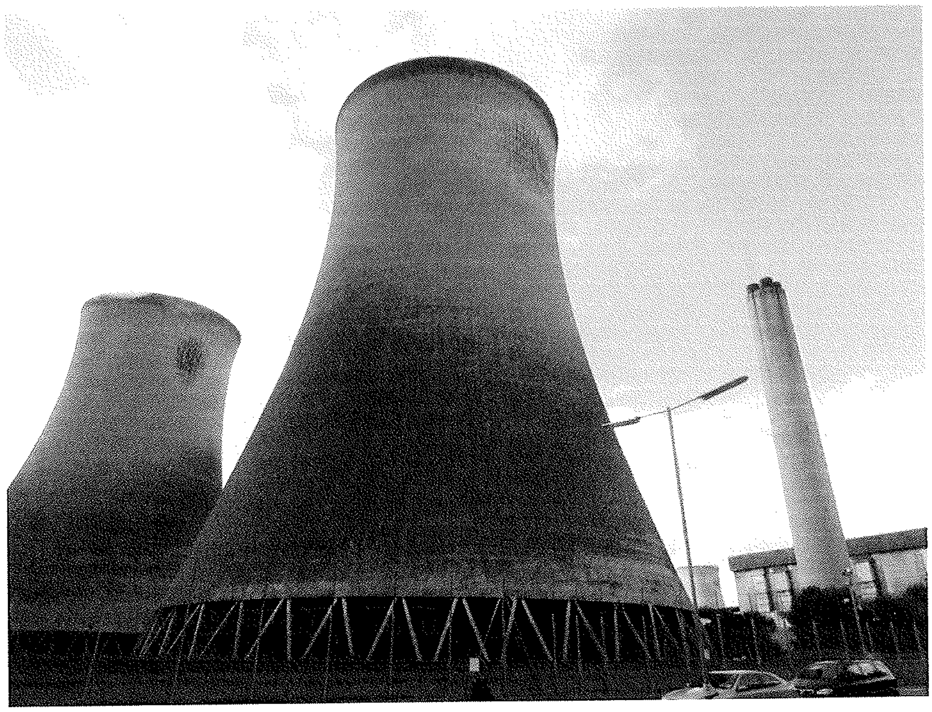


Figure 10.Grey reinforced concrete hyperbolic shell of cooling tower on reinforced concrete piloti and four-flue chimney for expulsion of combustion gases

Figure 11. 'The opium fields of Didcot'