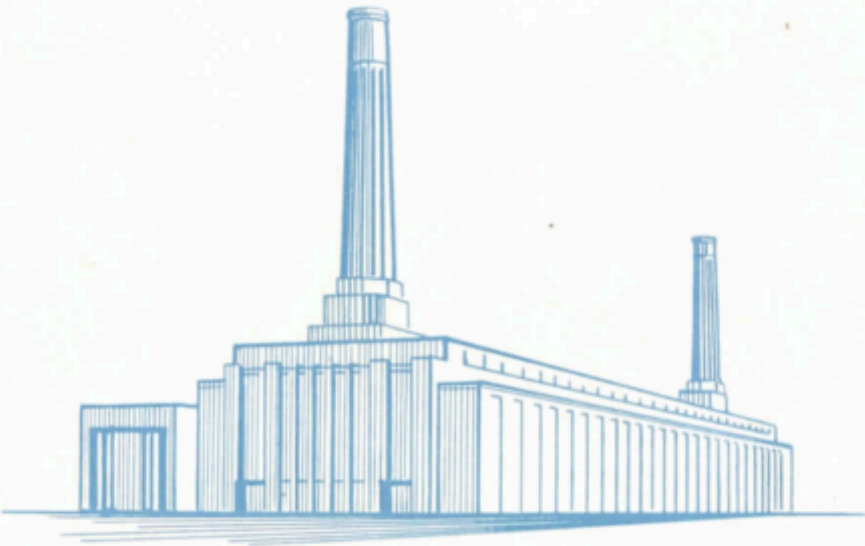
Uskmouth

Power Station

BRITISH ELECTRICITY AUTHORITY

SOUTH WALES DIVISION



USKMOUTH POWER STATION

October 1953

Rt. Hon. LORD CITRINE, P.C., K.B.E., Comp. I.E.E.
Chairman, British Electricity Authority

USKMOUTH
POWER STATION

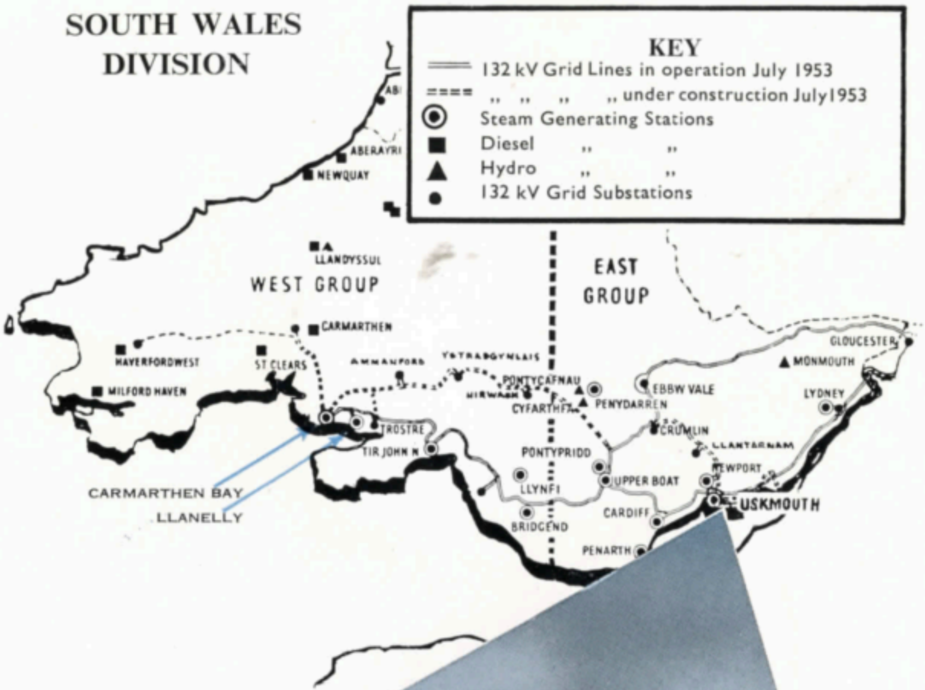
Before 1939, South Wales primarily served as an electricity exporter. However, due to increased industrial demands and delays in constructing new generating plants during and after World War II, South Wales began importing electricity during peak periods, especially in the summer when essential plant overhauls were conducted. By the summer of 1952, South Wales was importing up to one-third of its total load during peak periods, reaching the maximum import capacity under normal conditions. The necessity for new power stations was evident to ensure South Wales' energy self-sufficiency. Although the Uskmouth Power Station has provided substantial assistance and is expected to contribute more in the future, additional plants are required to meet the expanding load.

The initiative for constructing Uskmouth Power Station originated with the Newport Corporation in 1946 and was a vital project for the South Wales Division. Approval from the Central Electricity Board was obtained in September of that year under Section 6(1) of the Electricity (Supply) Act 1926. Loan sanction application was submitted to the Electricity Commissioners in 1947, and certain contracts were finalized before Vesting Day.

The project's development before Vesting Day was overseen by Mr. T. H. Wood, M.I.Mech.E., A.M.I.E.E., Borough Electrical Engineer for Newport, serving as the Consulting Engineer for the station. Mouchel and Partners played a significant role in the project as the Consulting Engineers for the civil engineering aspects.

The construction of Uskmouth Power Station commenced in 1950, with the first two 52.5 MW turbines and air-cooled alternators commissioned by 1953. The station strategically addressed South Wales changing energy needs and reduced dependence on external electricity imports during peak periods.

In conclusion, the Uskmouth Power Station project showcased the collaborative efforts of multiple stakeholders, ensuring South Wales journey towards energy self-sufficiency. The challenges posed by wartime constraints and increasing industrial demands were met with foresight and strategic planning, marking a significant milestone in the region's power infrastructure development.


SOUTH WALES DIVISION
KEY
132 kV Grid Lines in operation July 1953
,, ,, ,, ,, under construction July 1953
Steam Generating Stations
Diesel ,, ,,
Hydro ,, ,,
132 kV Grid Substations
ABERAYRI
NEWQUAY
LLANDYSSUL
WEST GROUP
EAST GROUP
CARMARTHEN
HAVERFORDWEST
ST CLEARS
MILFORD HAVEN
AMMANFORD
YSTRADGYNLAIS
PONTYCAFNAU
HIRWAUN
CYFARTHFA
PENYDARREN
EBBW VALE
CRUMLIN
LLANTARNAM
GLOUCESTER
MONMOUTH
LYDNEY
TROSTRE
TIR JOHN N
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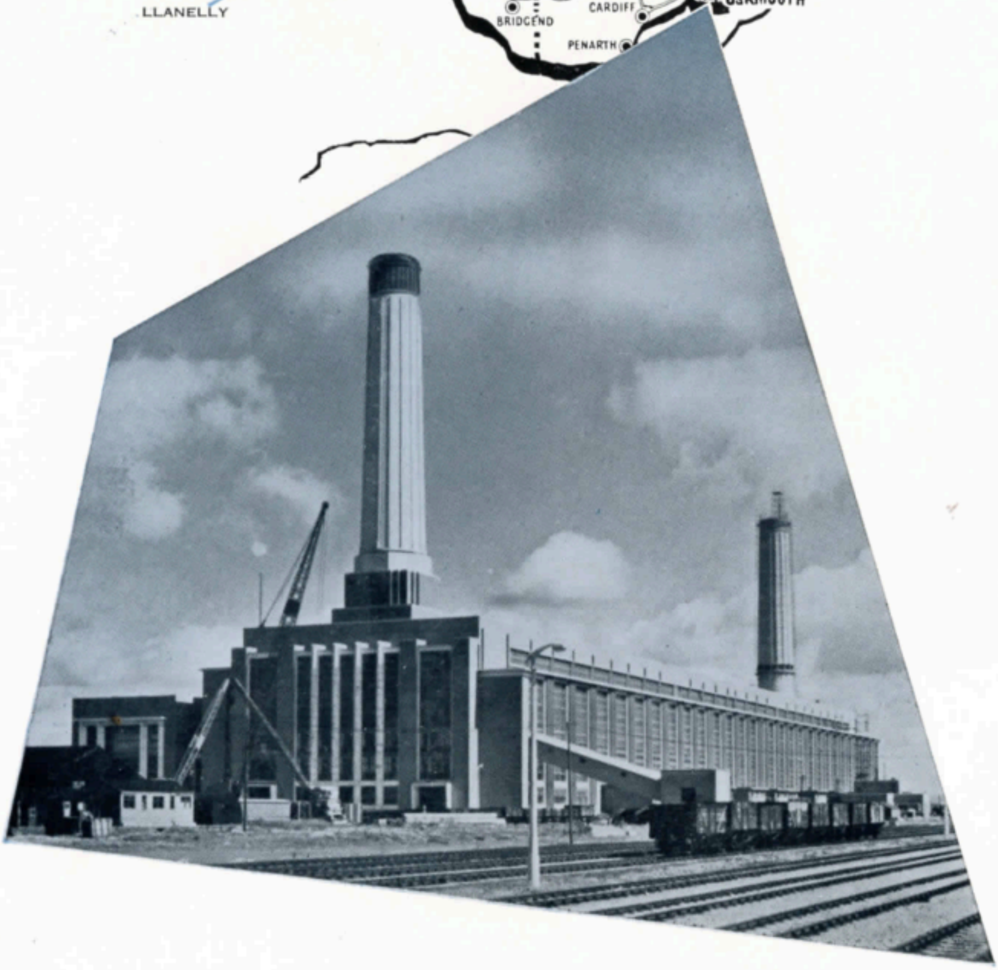


Limited and Sir William Halcrow and Partners served as Civil Engineering Consultants for the station and the river intake works, respectively. Mr. Johnson Blackett, F.RI.B.A., the Newport Borough Architect, held the role of Consulting Architect.

Following the nationalization of the electricity supply industry in 1948, when Uskmouth Power Station transitioned from the control of the Newport Corporation, the project was overseen by Mr. H. V. Pugh, M.I.E.E., M.I.Mech.E., the Controller of the South Wales Division of the British Electricity Authority. The Generation Construction staff, led by Mr. T. H. Wood as Chief Generation Engineer (Construction) for the Division, played a crucial role in directing the work. In October 1951, Mr. Pugh assumed the role of Controller of the London Division, and Mr. H. J. Bennett, A.M.I.E.E., succeeded him.

The Authority expresses gratitude for the invaluable help and advice received from various bodies during the construction of the modern power station in a rural area. Collaborative efforts from entities such as the Monmouthshire County Council, Usk River Board, Caldicot and Wentloog Levels Drainage Board, Newport Harbour Commissioners, British Railways (Western Region), Docks and Inland Waterways Executive, and neighbouring farmers, who contributed land for station needs, significantly facilitated the station's development.

Special appreciation is extended to the Newport Corporation for their continued interest and support throughout the station's development. The opening ceremony, led by His Worship the Mayor of Newport, Councillor William Pinnell B.E.M., symbolizes the enduring association between the Corporation and the station since its inception.

BRIEF HISTORY OF THE CONSTRUCTION

The construction of Uskmouth Power Station involved the development of a site covering approximately 600 acres at the entrance of the River Usk into the Seven Estuary region. Initially, the site comprised grazing land situated about four to six feet below the maximum high tide level, protected by earth banks and occasionally subject to flooding, with tidal salting’s beyond these banks.

To prepare the site, preliminary filling activities commenced in April 1948, focusing on creating eight miles of rail sidings and an access road to the station. Over the next twelve months, about 330,000 tons of quarry waste and 100,000 tons of slag from a burnt-out mine tip at Penygraig were imported. These materials were utilized to form banks above high tide level for the sidings and access road. Delivery methods included road and rail, with truck dischargers unloading rail trucks. Bulldozers, rollers, and scrapers were employed for spreading and consolidating.

Subsequently, additional works involved importing ordinary ash from the East Power Station in Newport to fill areas adjacent to the buildings, create hard standings for equipment storage, and establish working areas for various contractors. The construction also required modifications to existing surface drainage discharging to tidal flaps, the formation of new sea defence banks to enclose tidal salting's, and the drainage and building up of an area with ashes to provide coal storage space for 108,000 tons.

In October 1948, excavation work commenced on the basement of the main power station building, which included sealing off Thieves Pill, a water-worn gulley in the north-west corner of the site, with steel sheet piles and a hard-core bank.

The strata formation at the Uskmouth Power Station construction site consisted of several layers. The upper layer, about 10 to 12 feet thick, comprised estuarine deposits, consisting of soft peaty clay that had hardened through drying. Beneath this layer was a soft clay layer with an average thickness of 20 feet. Further down, there was a layer of sand intermingled with silt and clay, ranging in thickness from 5 to 20 feet. This layer rested on a substrate of stiff clay and small stones. The hard base below included sand, gravel, and boulders, occurring at an average depth of approximately 70 feet below ground level.

During the construction, efforts were made to ease the work, including fitting some piles with water jet equipment. However, it was discovered that the soft clay hindered the displacement of sand, and disruption of the overlying clay made it challenging to control the pile's toe as it entered the sand. Despite attempting water jetting at pressures up to 300 pounds per square inch, normal pile-driving methods, though demanding and difficult, had to be employed.

EXCAVATIONS AND BASEMENT CONSTRUCTIONS

Basement construction at Uskmouth Power Station commenced in April 1949 and proceeded at a pace determined by the progress of the piling activities. After finishing the retaining walls and backfilling, the next step involved driving piles from the existing ground level to provide support for various sections of the building. This included areas like loading bays, transformer bays, and the two chimney foundation slabs situated above the basement space.

FOUNDATION WORK

STEEL FRAMEWORK

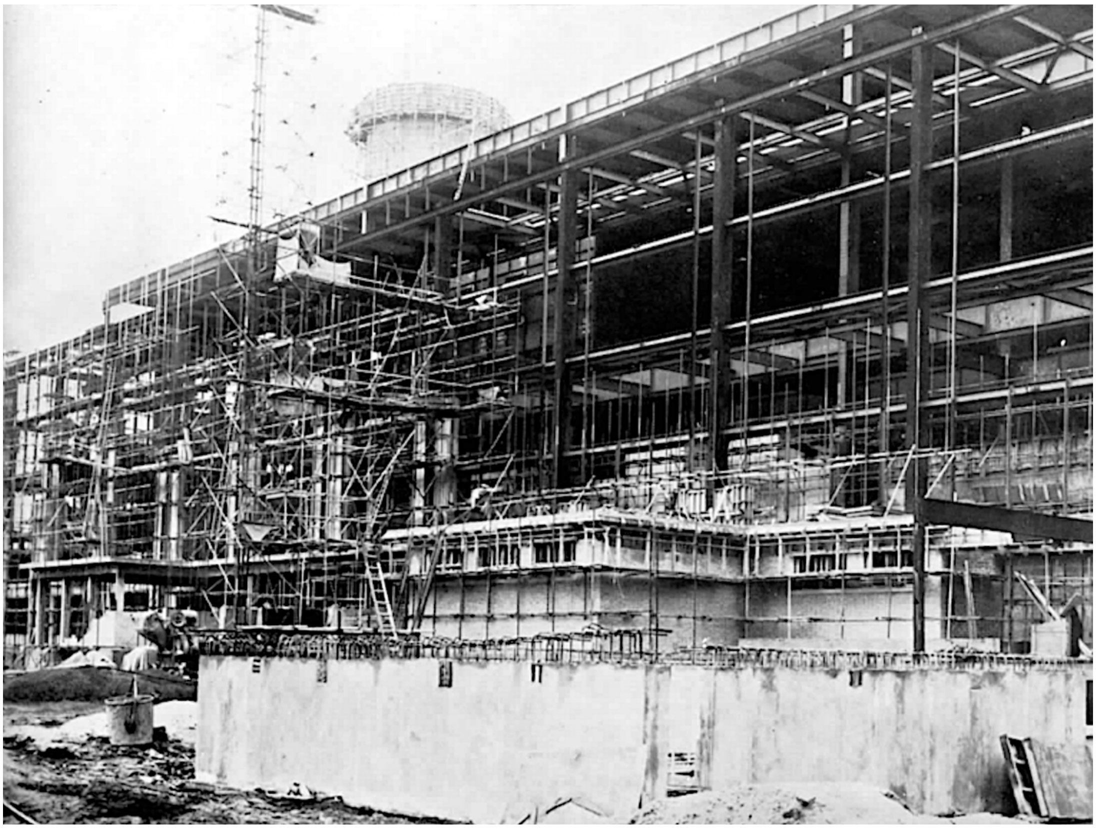
The construction faced significant challenges with the piles supporting the main station, each approximately 70 feet in length, particularly in close-grouped sections under the chimneys. At the west end, tubes were driven and cored out to depths below the sand belts, with a 70-feet pile pitched in the tube and driven the last few feet to achieve a satisfactory set in the marl. The main station required a total of 6,778 piles, averaging 55 feet in length. Basement-level piling was completed by August 1950, and high-level piling external to the retaining walls was finished by April 1951. An additional 450 piles, each 75 feet in length, were installed to support the separate 132,000-volt switch house north of the main station.

The deepest excavation for the ash sump at the centre of the 900 feet long main station was approximately 50 feet below the existing ground level and necessitated a sheet pile cofferdam strutted with frames made up of boxed pile sections. Difficulties were again encountered in excavations penetrating the stubborn sand and silt layers, which, when opened, exhibited the consistency of running sand. Work on the reinforced concrete circulating water ducting between the pumping station, main building, and the outfall point commenced in March 1950. The ducting, mostly circular internally with an eight-foot diameter, featured square sections running beneath the main building, measuring eight feet square internally. The total length of ducting was approximately 1.5 miles. Ducts were supported on precast concrete piles, and a combination of part-open cut and sheet-piled trench methods were employed during excavation.

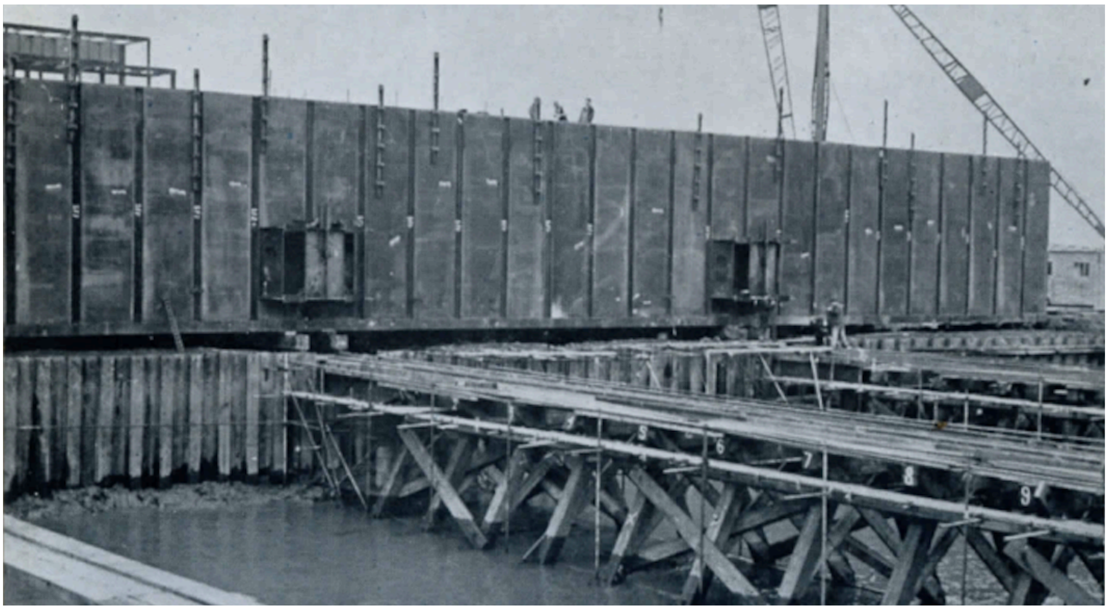
In June 1950, construction started on the coal handling plant buildings to the south of the main station. This included two double-sided tippler pits, two radial conveyor houses, conveyor tunnels, and ancillary buildings. The entire structure was supported on 520 precast concrete piles, with most driven from existing ground level, except those for the tippler pits reaching a formation level 22 feet below the original ground level. The majority of the reinforced concrete construction, totalling around 9,000 cubic yards, was completed by March 1952, with ongoing plant installation before finishing the upper structure and roof above existing ground levels.
The installation and ballasting of the eight miles of rail sidings for coal traffic commenced in early 1949. This process was executed incrementally to align with the demands of other concurrent construction activities. The majority of the track was laid on pre-stressed concrete sleepers. Cladding for the main station building and the separate 132,000-volt switch house involved the use of approximately 21,000 cubic yards of reinforced concrete in floors, bunkers, and encasings for the structural steel frame. The cladding also included 2,000,000 facing bricks and 3,800,000 engineering bricks. This cladding initiative commenced in August 1950 and is now nearly finished.

The construction of the west chimney stack, made of reinforced concrete and standing at 200 feet above roof level, featuring a single brick lining and air space, started in June 1951, and concluded, including the architectural plinths at its base, in April 1952. The east chimney, designed similarly to the west chimney, is anticipated to be completed by the end of 1953.

CONSTRUCTION PROGRESS



NORTH FACE OF CAISSON PRIOR TO ROLLING OUT



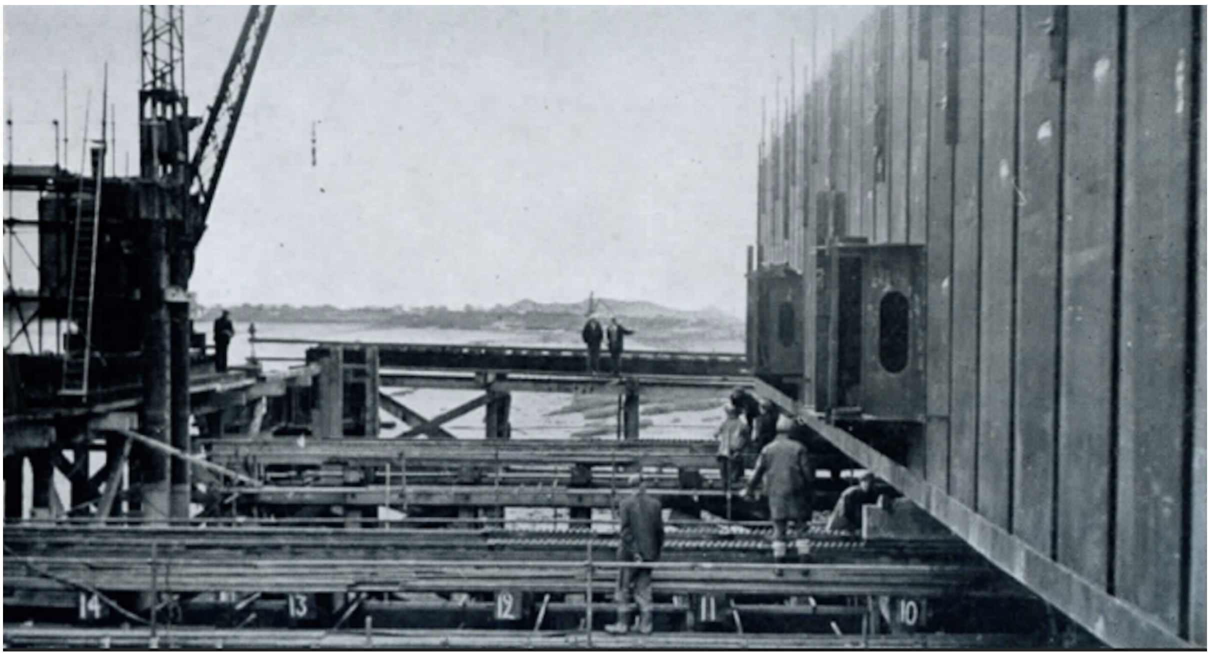
WORLD'S LARGEST CAISSON

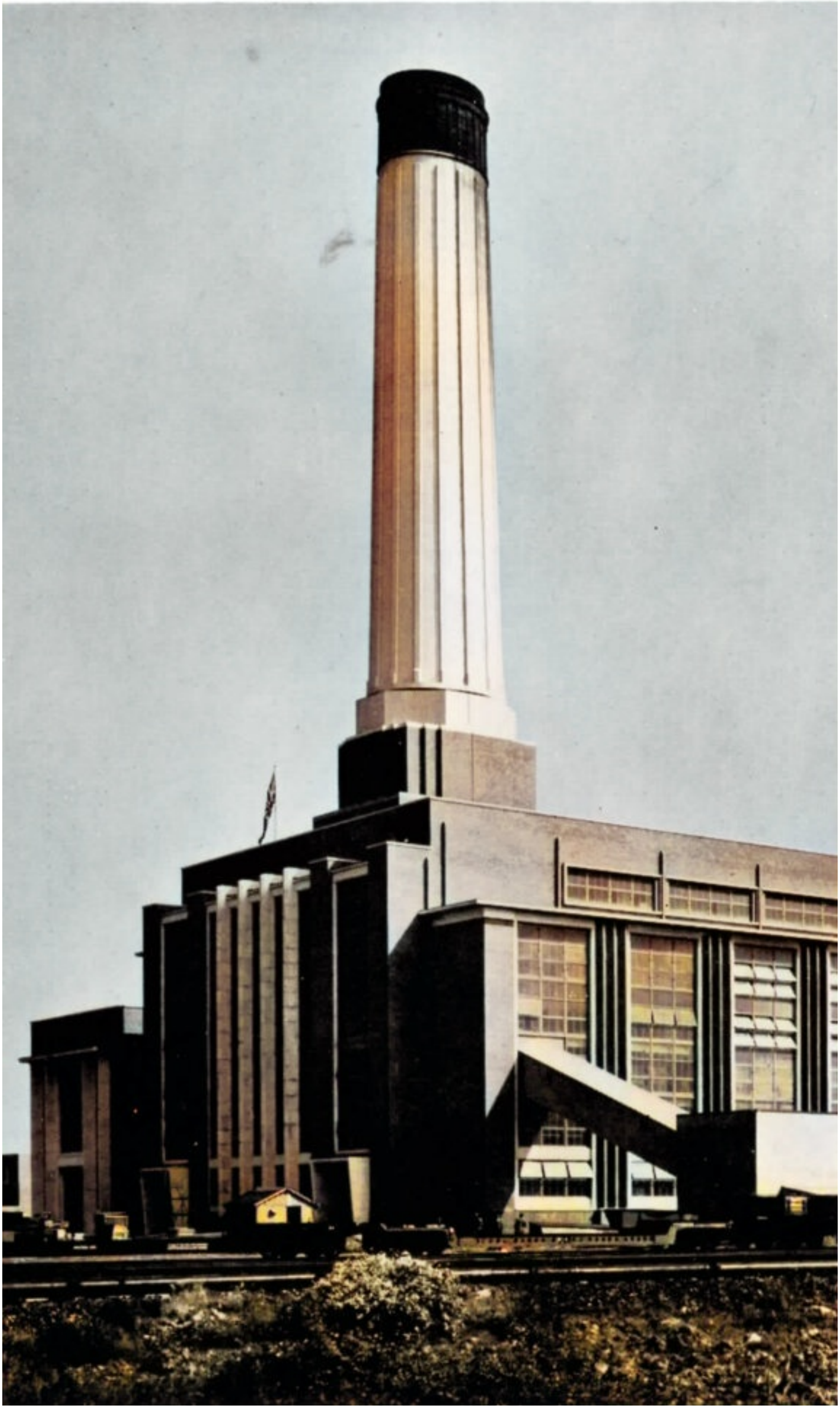
A colossal caisson, believed to be the world's largest, was strategically positioned on the Uskmouth foreshore to secure a water supply at the lowest tide level for cooling purposes.

The caisson steelwork, an entirely welded structure forming the caisson shoe and working chambers, was ingeniously compartmentalized into three equal-sized sections. Two internal transverse bulkheads within the structure accommodated spine trusses, serving as support for roof girders over the working chambers.

Constructing the caisson posed a unique challenge due to the weakness of the foreshore. To address this, the 580-ton steel shoe of the caisson was assembled on stable ground away from the riverbank. Subsequently, the shoe was elevated on ball carriages behind the riverbank and moved along two tracks, aligning with the bulkheads' positions. It was then gradually lowered by hydraulic jacks onto a prepared and level hardcore bed on the foreshore, just above high tide.

The caisson design featured six airlocks, and the structure was equipped with six 2-ton electric derrick cranes. These cranes played a crucial role in handling buckets for the removal of excavated material from the working chamber during the caisson's submersion process.





TECHNICAL DETAILS

BUILDING AND CIVIL ENGINEERING WORK

The main structures, including the switch house, rest upon a combined total of approximately 7,200 pre-cast concrete piles with an average length of 55 feet. These buildings employ steel framing with brick cladding, featuring roofs constructed from pre-cast concrete slabs overlaid with a combination of cement screed, granulated cork, and asphalt.

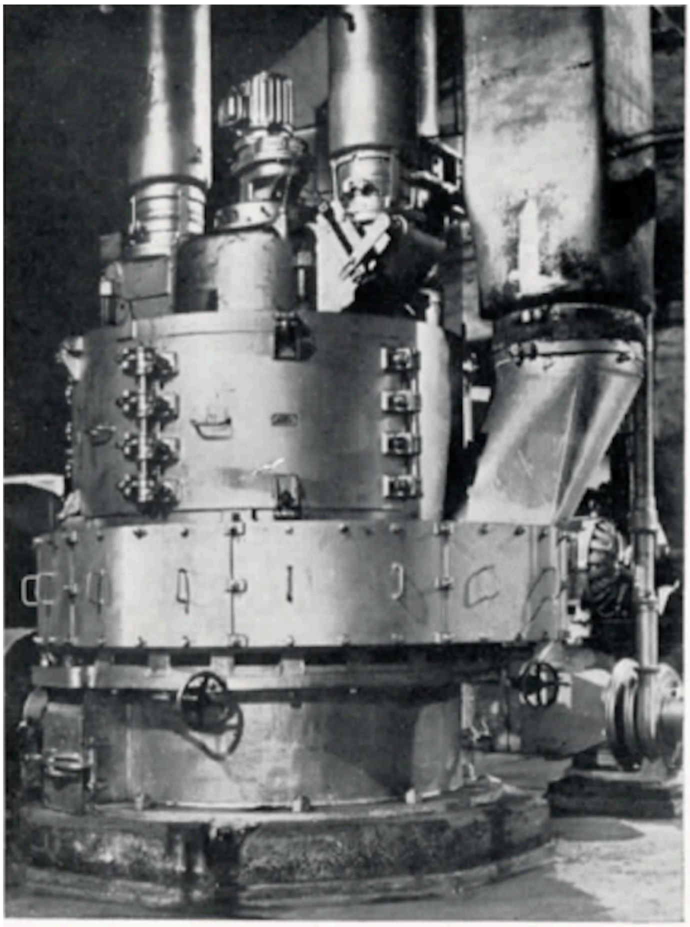
Positioned at each end of the boiler house are two reinforced concrete chimneys, soaring to a height of 300 feet above ground level. The main building stretches an impressive 896 feet in length and spans 270 feet in width. The general ground level is at +28 O.D., while the operating floor and basement levels are at +34 O.D. and +6 O.D., respectively.

Housing the circulating water pumps is a reinforced concrete caisson measuring 164 feet by 110 feet. This caisson boasts a welded steel and concrete base, with its bottom situated approximately 80 feet below ground level. The superstructure of the pump house is steel-framed and clad in brick, consistent with the architectural theme of the other buildings.

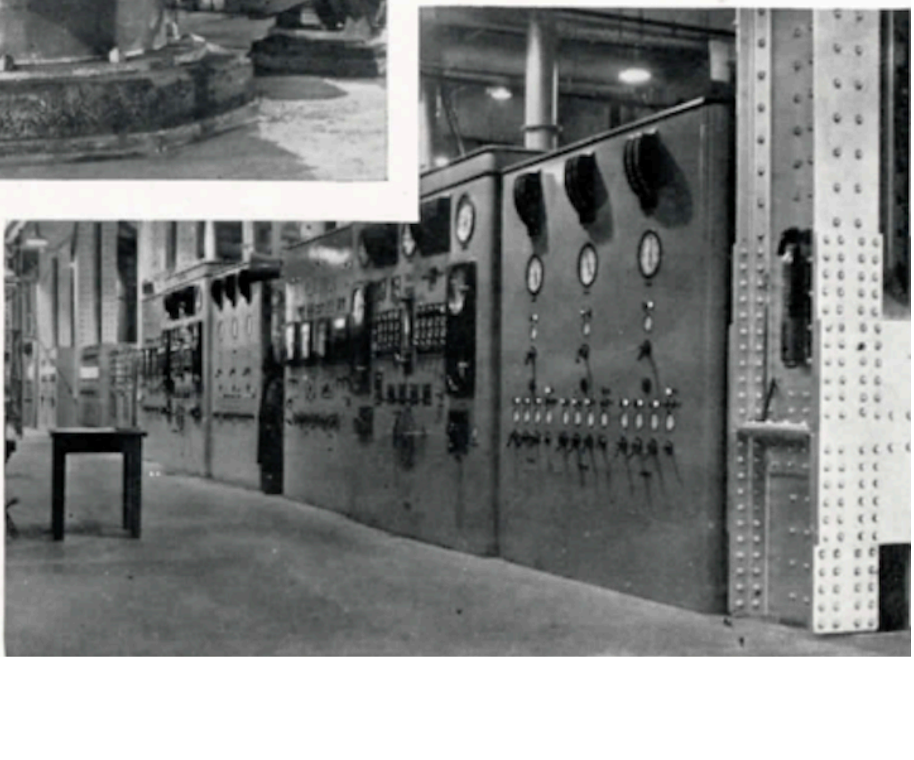
The 132,000-volt switch house, serving as the main control room, is specially engineered to withstand the shock generated by the air-blast switchgear's operation.

BOILER PLANT

The boiler plant is equipped with twelve boilers, each capable of producing 360,000 lb of steam per hour at a pressure of 950 lb per square inch and a temperature of 925°F. The process involves coal being fed from the bunkers into the pulverizing plant, which comprises three pressure-type mills for each boiler. Initial firing of the twelve downdraft burners at the front of the furnace chamber is facilitated by an electrically ignited oil lighting-up system.

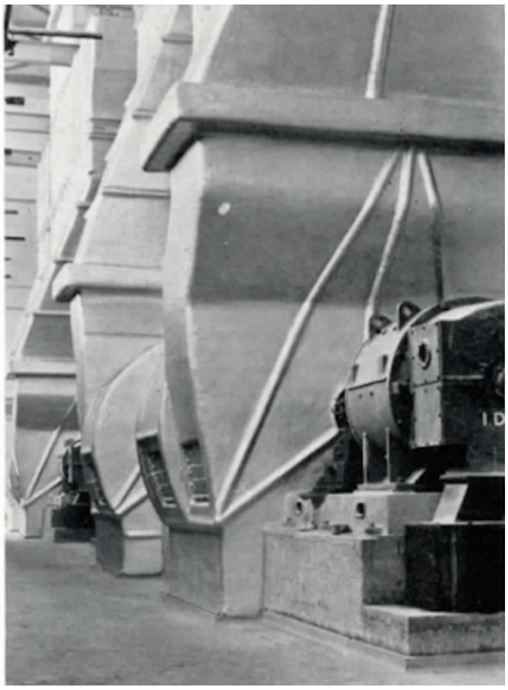


PULVERISING MILLS



BOILER
CONTROL
PANELS

INDUCED DRAUGHT
FANS



The draught plant in the facility is designed with redundancy, featuring duplicated systems. The air for the forced draught fans is drawn from the top of the boiler house, allowing for the reclamation of heat. Each forced draught fan is responsible for delivering air to a rotary air heater, and a system of ducting is in place to distribute the air for combustion throughout the facility. This setup ensures efficient and reliable operation, with the added benefit of utilizing reclaimed heat for optimal energy efficiency.

BOILER HOUSE MAIN AISLE

The combustion gases undergo a thorough treatment process within the facility. After passing through the boiler, superheater, and economizer surfaces, they are directed through the gas side of the air heaters. Due to the heavy load of dust and grit in these gases, mechanical Centicell collectors are employed, followed by electrostatic precipitators. Subsequently, the treated gases are released to the main flue and chimneys through induced draught fans.

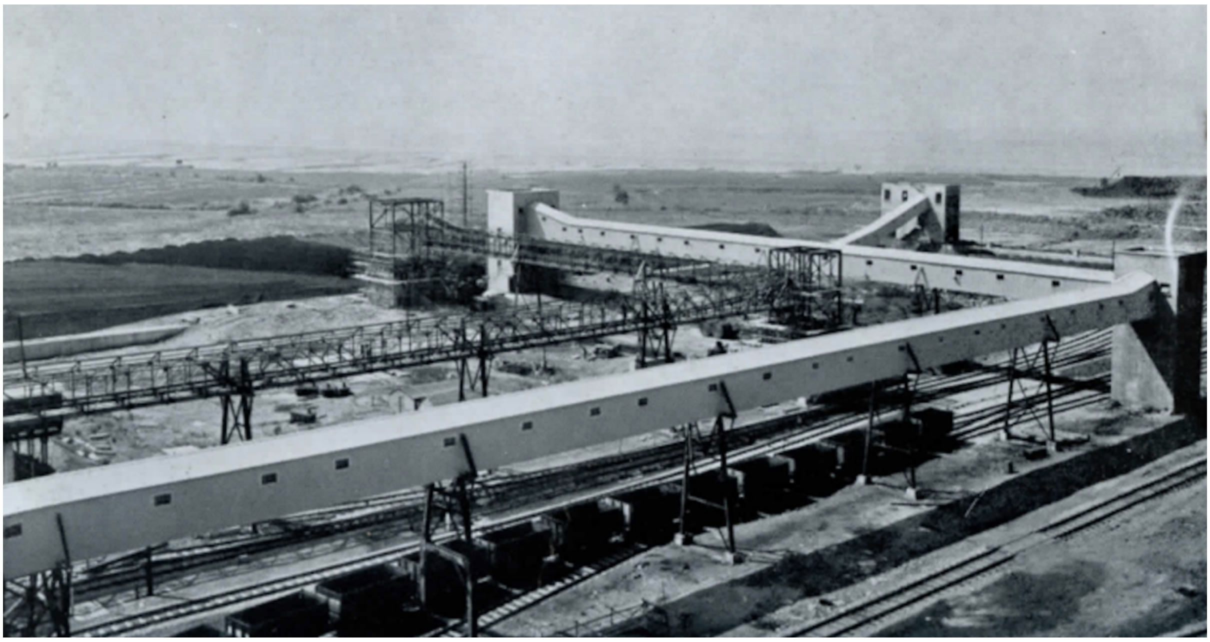
For efficient boiler control, an automatic system is implemented using compressed air as the operating medium. This system governs the control of fuel, steam pressure, air for combustion, gas analysis, and furnace pressure.

The steam generated from each pair of boilers is conveyed to a steam receiver, and from there, a pair of leads supplies the associated turbine. Additionally, a branch from the steam receiver provides auxiliary steam for various purposes, including the central evaporating plant, deaerators, steam feed pumps, ejectors, and the heating system for the office and switch house. To optimize boiler capacity utilization, six receivers are connected in pairs.

COAL HANDLING PLANT

The coal handling plant is structured to accommodate rail borne coal and is partitioned into two sections. Each section has the capability of delivering 300 tons of coal per hour to any of the twelve bunkers within the facility.

COAL CONVEYORS



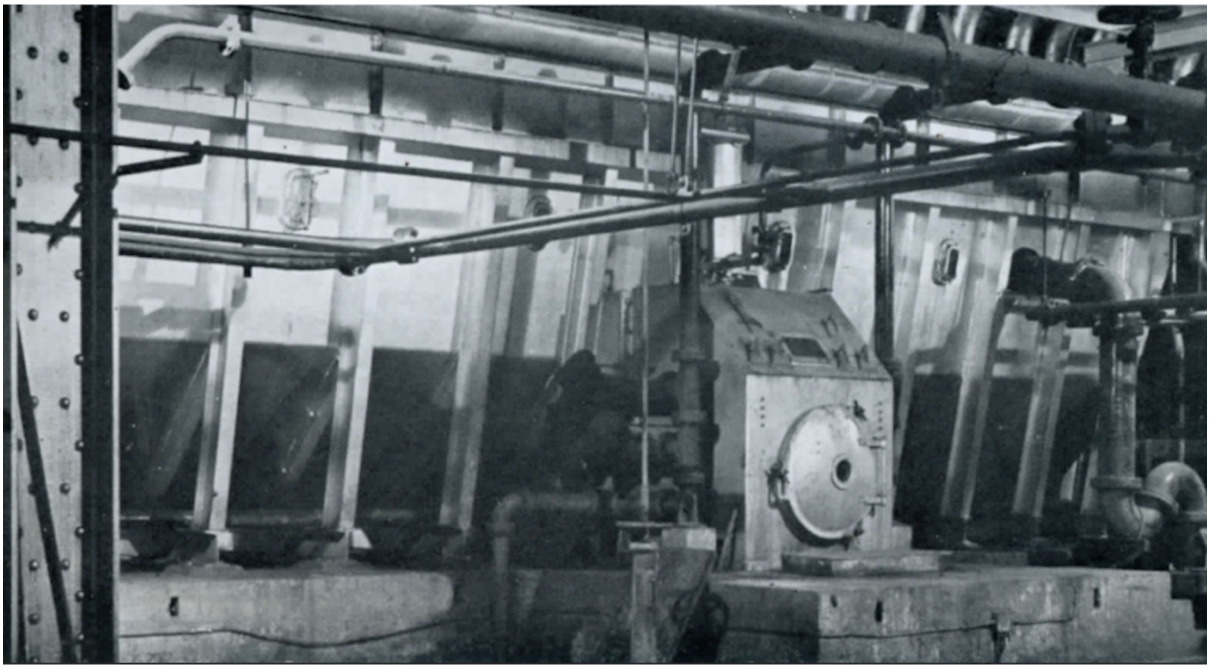
Coal is unloaded from railway trucks using two double-sided tipplers. It is then transported on 36-inch belt conveyors to a central location. From there, it is distributed either to the stockpile using bulldozers or, via additional belt conveyors, to the bunkers through the crushing and screening plant. The coal undergoes automatic weighing at each stage of the process as it makes its way to the bunkers.

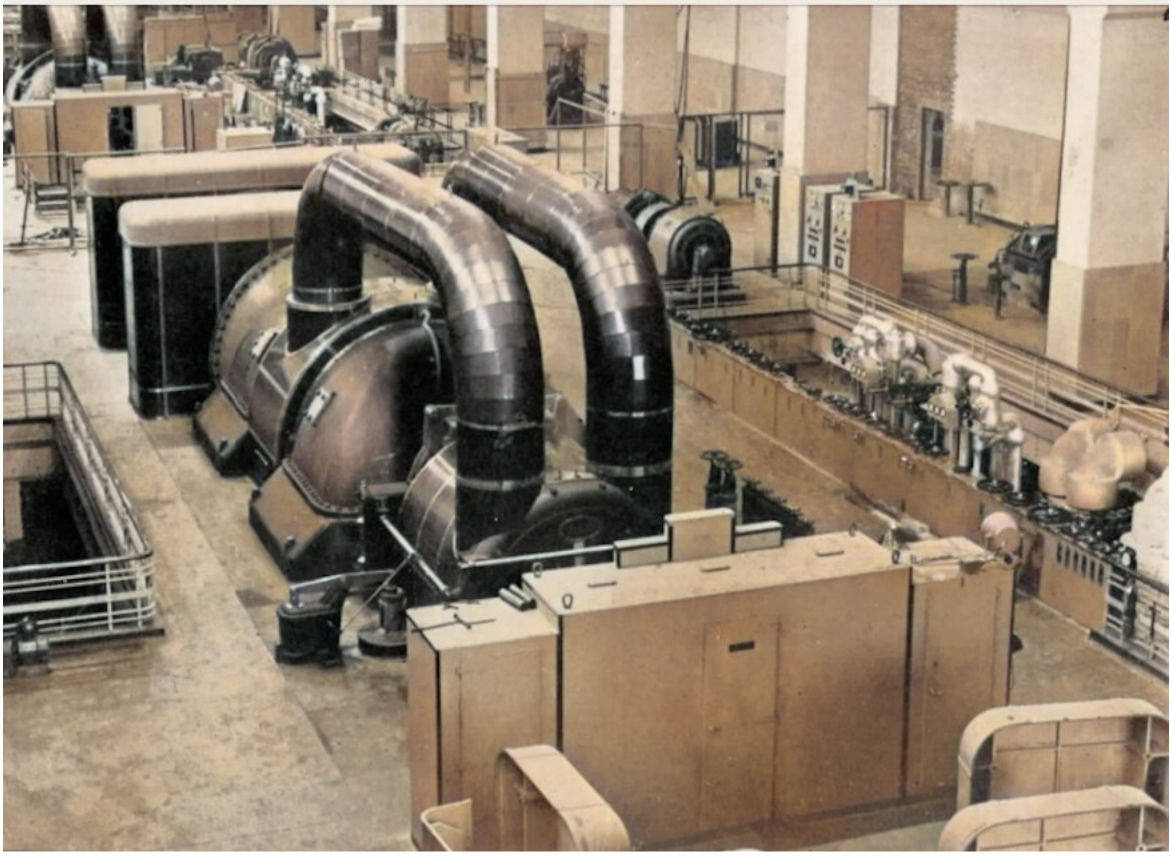
ASH HANDLING PLANT

Each boiler is equipped with a water-filled ash hopper where the hot ash is deposited and rapidly cooled. At intervals, the ash is released from the hopper into a sluiceway. High-pressure water jets drive the ash along the sluiceway to the central ash pit. Dust from the precipitators follows a similar path to the ash pit.

Subsequently, the ash undergoes crushing and is mixed with water. The resulting mixture is pumped to the ash disposal ground. There, it is left to dry and will ultimately be covered with soil.

HYDROJET ASH PLANT





TURBO-ALTERNATOR PLANT

The turbine plant comprises six 60,000-kilowatt, 3,000 rpm turbo generators of the two-cylinder, multistage impulse type. Steam is provided at a pressure of 900 lb per square inch and a temperature of 900°F. For feed heating purposes, steam is bled at three points from the high-pressure cylinder and two from the low-pressure cylinder. The bled steam from the first low-pressure (direct contact) heater is divided and abstracted from equal points on each of the two low-pressure cylinders.

After passing through the turbine, the steam is exhausted into twin condensers, and air is extracted by two three-stage steam-operated air ejectors, each capable of 100 per cent duty. The condensate is then removed by single-stage horizontal extraction pumps, delivering directly to the first stage of the feed heating system, where the bled steam from the low-pressure system mixes directly with the condensate. Extraction pumps deliver the water to the second low-pressure heater of the orthodox "U" tube type.

The water then proceeds to the feed pump suction main, from which it is drawn by the boiler feed pumps for delivery to the three high-pressure feed heat stages before its final delivery to the boilers. A shunt deaerator of the spray type is incorporated between the low-pressure and high-pressure stages, with a storage vessel between the suction main and the surge tanks to handle variations in demand on the feed pumps.

The high-pressure feed heaters are equipped with the normal spring-loaded automatic bypass valve for protection against flooding in the event of a tube failure. The alternator, separately excited, generates at a voltage of 11,800 and is cooled with hydrogen at a pressure of 4 lb per square inch. The output from the alternator is fed directly to a 70 MVA transformer, transforming the voltage to 132,000. A 6,000 kVA unit transformer is also connected directly to the alternator output to provide current at 3,300 volts for the associated auxiliary plant.

FEED WATER SYSTEM

The feed suction and delivery mains are shared among all sets, with section valves in the line to separate the various sections. Eight multistage boiler feed pumps are provided, each driven by a 1,550-horsepower motor from the 3,300-volt supply. Additionally, two steam turbo-driven pumps start automatically in the event of an electrical supply failure, causing a drop in pressure in the feed line.

Water from the feed pumps can be delivered either directly to the boiler economizer check valves or via the Cope's feed regulating valves. A topping-up connection is provided on the Cope's feed line. Feedwater make-up, constituting approximately 4 per cent of the total steam consumption, is sourced from the town's water supply through softening and evaporating plant facilities.

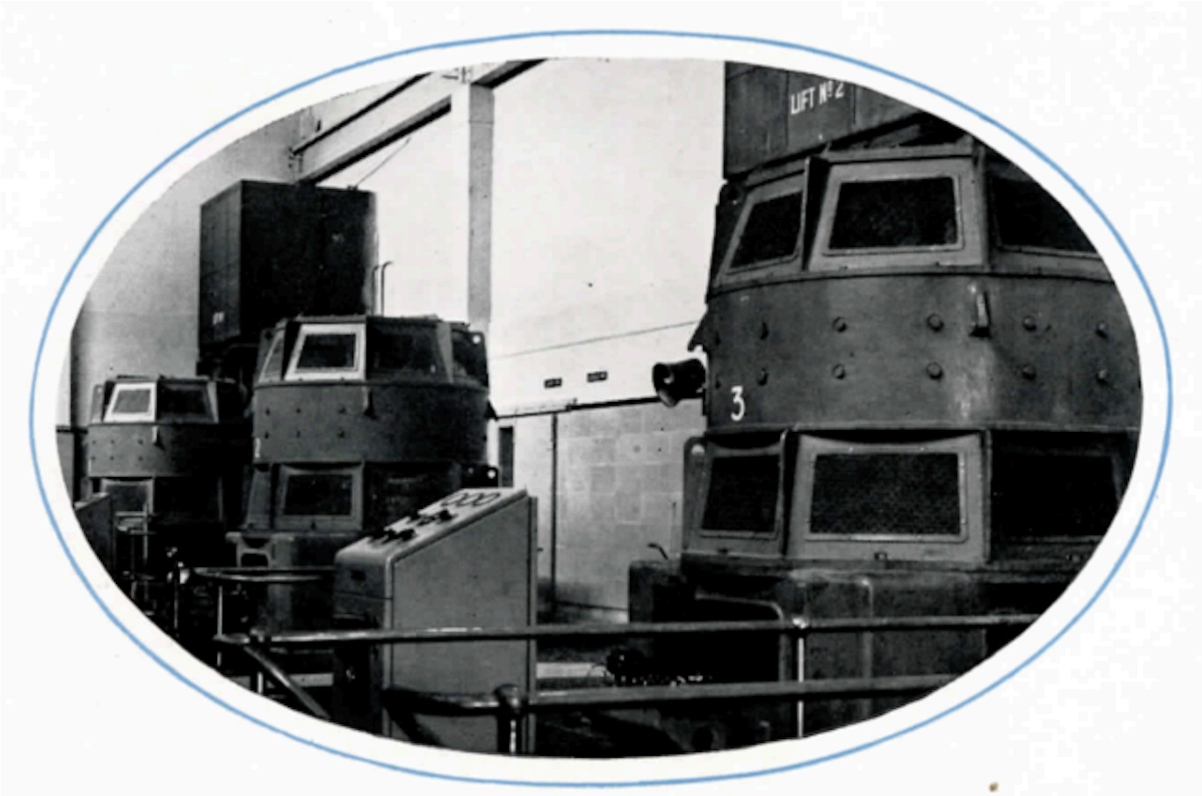
CIRCULATING WATER SYSTEM

Circulating water required for cooling purposes is drawn from the River Usk through eight pumps, each capable of handling 2½ million gallons of water per hour. Due to the substantial rise and fall in tide on this river, which, at times, has a range of 43 feet, these pumps are driven by variable-speed direct current motors, each with a capacity of 1,100 horsepower. They are strategically located in the pump house at a depth that ensures they are below the level of the lowest tide.

Water is extracted from the pump house along two reinforced concrete ducts to the center of the turbine house. Here, the ducts branch into two sections, with one section managing the condensers of the first three turbines and the other handling the second three turbines. The discharge is then directed through two additional ducts running parallel to, but at a lower level than, the condenser inlet ducts to a point approximately 3,000 feet higher up the river than the inlet point.

The outfall has been designed to maximize the aeration of the discharged circulating water, aiming to preserve fish life in the river.

CIRCULATING PUMP MOTORS



ELECTRICAL EQUIPMENT

The station's auxiliary supplies are derived from two station transformers with a ratio of 132,000/3,300 volts and from six unit transformers with a ratio of 11,800/3,300 volts. These transformers are positioned along the north wall of the turbine house, and the associated 3,300-volt oil-break switchgear is housed in three switch houses also situated along the length of the turbine house's north wall.

Power for the coal and ash handling plant and other shared services is drawn from the station transformer via the station switchboard. Supplies for equipment linked to each turbine and boiler unit are sourced from the corresponding unit transformer through a unit switchboard. Connections between each unit switchboard and the station switchboard are established for startup and standby purposes.

The variable voltage direct current (D.C.) supply needed for operating the circulating water pumps and boiler fans is obtained from grid-controlled mercury arc rectifying plant supplied with alternating current at 3,300 volts from either the station or unit transformers. Sixteen transformers supply current at 415 volts for lower voltage auxiliary plant.

Lighting current is provided by two main transformers, and a certain number of lighting points have been configured to be fed automatically from the station battery in case of a main supply failure.

In the case of a prolonged failure, a 50-kilowatt diesel generating set is employed to supply power to the emergency lighting circuits.

Cables linking the 132,000-volt switchgear with the generator transformers and the Grid network are of the oil-filled type and are laid either directly in the ground or in ducts. A primary cable tunnel runs along the north and south walls of the main building, with the south wall tunnel dividing into three sections. The north wall tunnel, situated beneath the three switch houses, accommodates all the cables from the auxiliary switchboards. The three sections of the cable tunnel on the south wall are positioned below the boiler fan rectifier equipment.

Cabling between the north and south wall tunnels traverses the main building on banks of trays at three main crossing points.

Paper-insulated lead-covered cables are utilized for all 3,300-volt and higher voltage circuits, as well as on the 415-volt circuits carrying heavy current. Mineral-insulated copper-clad cable has been extensively used for other 415-volt and 240-volt lighting circuits, while certain lighting circuits are implemented with aluminum-sheathed rubber cables and rubber cables in conduit.

MAIN SWITCHGEAR

The Uskmouth main switchgear operates at 132 kV and employs an indoor air-blast design. Generators are connected to the switchgear through transformers, elevating the voltage from 11,800 volts to 132,000 volts, with no switchgear on the 11 kV side.

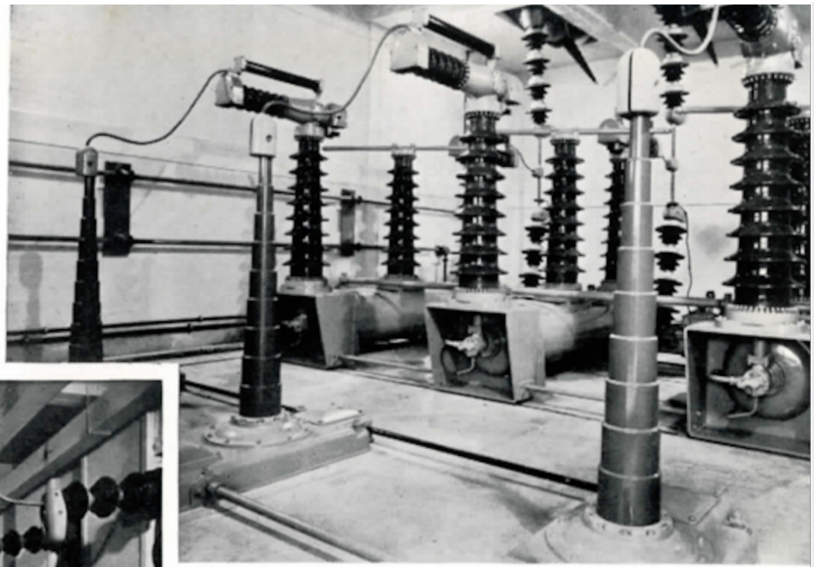
Situated in an adjacent switch house, the switchgear utilizes oil-filled 132,000-volt cables to connect the generator transformers, with cable sealing boxes at the transformers and sealing ends in the switch house.

The 132 kV switchgear, boasting a rupturing capacity of 3,500 MVA, is positioned in two blocks flanking a central control room. All auxiliary circuit-breakers align with this control room, while the main busbar is housed above, and the reserve busbar occupies ground floor chambers. Connectivity involves a bus section switch and isolators at the top busbar chamber level, and a reactor facilitates selection between busbars.

Distinguished by a unique layout, switch units reside in separate cubicles with isolators featuring synthetic resin-varnish paper condenser bushings. Bushings traverse walls and floors, forming the isolator switch blade. Testing connections enable Schering Bridge insulation tests while in service.

Local control panels in switchgear cubicle corridors oversee each circuit equipment, and isolator operating mechanisms are accessible on these panels for manual operation via a handwheel. Each panel includes a local diagram of the complete circuit-breaker unit, along with mechanically operated semaphores indicating equipment positions. Rigorous interlocking ensures safety and operational integrity.

Air for circuit-breaker operation is supplied through a duplicate copper bus main from the ground floor compressor room, housing four air compressors, common air receivers, and a compressor control cubicle. Pressure reduction from 600 lb per square inch to 325 lb per square inch occurs before reaching the circuit-breaker unit receivers.



AIR BLAST SWITCHGEAR

132 kV BUSBARS

Low voltage auxiliaries draw power from the generating station through two ground floor switchboards, one at 415 volts, 3-phase, and the other at 415 volts, 3-phase with neutral. Sealing ends for feeders and generators terminate in cubicles alongside voltage transformers with a single-phase ratio of 76,200/635 volts. Fire risk considerations lead to the provision of CO2 equipment solely in cubicles containing sealing ends and voltage transformers.

The control room, located on the first floor at the building's center, houses the 132,000-volt main control board, two generator control desks, an operator's desk, the 3,300-volt control board, and a voltage regulator panel. The relay room and meter room sit directly behind the control room.

Given the bare paper insulation on the switchgear, air conditioning is imperative. Steam for this purpose is supplied by the power station, operating through an air conditioning plant in the switch house. Conditioned air is distributed via sheet steel ducting throughout the building, with humidity and temperature control facilitated by electrically operated dampers in the switchgear cubicles and busbar chambers.

Connection to the 132,000-volt Grid is achieved through six lines reaching Gloucester, Cardiff, Upper Boat, Lydney, and two to Llantarnam, with tee connections to Newport. Terminal towers adjacent to the building receive 132,000-volt cables terminated in sealing ends, with isolation and earthing procedures executed within the switch house.

H. J. BENNETT, A.M.I.E.E.

E. HYWEL JONES
M.I.E.E., M.I.Mech.E.

C. W. A. PRIEST
A.M.I.Mech.E., M.I.E.E

W. LLOYD WILLIAMS
A.M.I.E.E., A.M.Inst.F.

T. H. WOOD
M.I.Mech.E., A.M.I.E.E.

BRITISH ELECTRICITY AUTHORITY

SOUTH WALES DIVISION

H. J. BENNETT, A.M.I.E.E.
Divisional Controller

E. HYWEL JONES, M.I.E.E., M.I.Mech.E.
Chief Generation Engineer (Operation)

C. W. A. PRIEST, A.M.I.Mech.E., M.I.E.E.
Chief Generation Engineer (Construction)

W. LLOYD WILLIAMS, A.M.I.E.E., A.M.Inst.F.
Station Superintendent

T. H. WOOD, M.I.Mech.E., A.M.I.E.E.
Retired from the post of Chief Generation Engineer (Construction) on 30th April, 1953, and was succeeded by Mr. Priest.

Civil and Plant Details

CIVIL WORKS

MAIN BUILDING

- Overall length: 896 ft.
- Overall width: 270 ft.
- Height above ground level: 94 ft.
- Depth below ground level: 22 ft.
- Number of reinforced concrete piles: 6,778.
- Average length of piles: 55 ft.
- Reinforcing steelwork: 10,000 tons.
- Structural steelwork: 15,500 tons.
- Number of bricks: 5,800,000.
- Roof area: 6 acres.

CHIMNEYS

- Number of chimneys: Two.
- Height above ground: 300 ft.
- Internal diameter: 25-0" at exit.
- Type of construction: Reinforced concrete.

132kV SWITCHGEAR HOUSE

- Overall length: 400 ft.
- Overall width: 100 ft.
- Height above ground: 52 ft.
- Number: 200 reinforced concrete.
- Structural steelwork: 1,100 tons.

RIVER PUMP HOUSE

- Overall length at ground level: 182 ft.
- Overall width at ground level: 140 ft.
- Height above ground: 40 ft.
- Foundation level below ground level: 80 ft.
- Weight of steel caisson: 580 tons.
- Weight of reinforced concrete substructure: 40,000 tons.
- Structural steelwork: 300 tons.

RAILWAY SIDINGS

- Total length of sidings: 8 miles.
- Capacity of full wagon sidings: 480 wagons.
- Handling rate of 10-ton wagons (4 tipplers): 60 per hour.

CIRCULATING WATER CULVERT

- Total length of culverts (inlet and discharge): 1 mile.
- Internal dimensions: 8 ft sq, 8 ft dia.
- Type of construction: Reinforced concrete.

TURBO-ALTERNATORS

- Make: G.E.C. Fraser & Chalmers.
- Alternators: 6 x 60,000 kW Hydrogen-cooled alternators.
- Hydrogen pressure: 0.5 p.s.i. gauge.
- Turbines: Six—Multistage impulse turbines.
- No. of cylinders: Two.
- No. of stages: Twenty.
- Speed: 3,000 revs. per minute.
- Overall length of set: 65 ft.
- Overall width of set: 18'.
- Voltage of generation: 11,800 volts.

STEAM RAISING PLANT

BOILERS

- Manufacturer: Babcock & Wilcox, Limited.
- Boiler units: 12 x 360,000 lb per hour at 950 p.s.i. and 925°F.
- Type: High head, single drum.
- Furnace: Bailey Hopper.
- Furnace heating surface: 4,625 sq ft.
- Furnace volume: 26,500 cu. ft.
- Superheater: Multiloop draining type, in two sections.
    - Heating surface:
        - Primary: 10,800 sq ft.
        - Secondary: 3,960 sq ft.
- Attemperators: Surface type.
    - Number per boiler: Two.
    - Heating surface (each): 241 sq ft.
- Economiser: Multiloop steaming type.
    - Heating surface: 21,100 sq ft.
- Air heater: Howden Ljungstrom.

    - Number per boiler: Two.
    - Heating surface (each): 25,950 sq ft.

I.D. FANS

- Type: Howden turbovane.
- Number per boiler: Two.
- Volume at M.C.R.: 84,000 c.f.m.

CENTICELL COLLECTORS

- Make and type: Howden Centicell.
- Number per boiler: Two.
- Capacity of hoppers: Twenty-three tons each arrestor.

ELECTROSTATIC PRECIPITATORS

- Make: Sturtevant Engineering Co.
- Number per boiler: One.
- Hopper capacity: 108 tons each precipitator.

ELECTRICALLY DRIVEN BOILER FEED PUMPS

- Manufacturer: Mather & Platt, Ltd.
- Number and capacity: Eight each of 700,000 lb/hr.

FIRING EQUIPMENT

- Mills, number and type: Three Babcock & Wilcox E.50.
- Burners, number and type: Twelve Babcock & Wilcox Triple Port.
- Maximum capacity total: 43,800 lb/hr.

TURBO DRIVEN BOILER FEED PUMPS

- Manufacturer: G. & J. Weir & Co., Ltd.
- Number and capacity: Two each of 700,000 lb/hr.

FEED TANKS

- F.D. FANS: Howden B. Design 4.
    - Number per boiler: Two.
    - Volume at M.C.R.: 48,000 c.f.m.
- Six surge tanks.

- Six reserve tanks.
- Three softened water tanks.
- Three raw water tanks.
- Capacity each: 17,500 galls.

CIRCULATING WATER PLANT

- *Manufacturer*: Gwynnes Pumps, Limited.
- *Type of pump*: Vertical spindle, double entry, centrifugal.
- *Number of pumps*: Eight.
- *Capacity of pumps*: Each 300,000 galls/hour.
- *Horsepower*: Each 1,100.
- *Normal working head*: 65 ft.
- *Max. circulating water required*: 15,000,000 galls/hour.
- *Circulating water screens*: Eighteen.
    - *Manufacturer of circulating water screens*: F. W. Brackett & Co.
    - *Capacity of screens*: Each 1,500,000 galls/hour.
    - *Type of screens*: Central flow, band type.

ASH AND DUST HANDLING

- *Manufacturer*: Babcock & Wilcox, Limited.
- *Method*: Centicell collectors and electrostatic precipitators.
- *Ash handling*: From boiler hoppers to central ash sump and via ash pumps to ash ponds.
- *Total area for ash ponds*: Approximately 350 acres.

FEED HEATING AND CONDENSING PLANT

- *Manufacturer*: Hick Hargreaves & Co., Ltd.
- *Type*: Regenerative-five stage.
- *Condenser vacuum (twin condensers)*: 28.9 ins. Hg.
- *Shunt deaerator-storage vessel*: 4,000 galls.

COAL HANDLING PLANT

- *Manufacturer*: Babcock & Wilcox, Limited.
- *Type of conveyors*: 36" endless belt.
- *Capacity per belt*: 300 tons per hour.

- *Total capacity of plant*: 600 tons per hour.
- *Wagon tipplers*: Two pairs.
    - *Type*: Side tipping.
    - *Capacity*: Each 150 tons per hour.
- *Capacity of coal store*: 108,000 tons (10 ft. deep).
- *Area of coal store*: Eleven acres.
- *Number of bunkers*: Twelve.
    - *Construction of bunkers*: Reinforced concrete.
    - *Capacity of bunkers*: 700 tons each.
    - *Availability of bunkers at 100% load factor*: 36 hours.
- *Method of reclaiming coal from store*: Bulldozers and scrapers.

SWITCHGEAR

132kV SWITCHGEAR

- *Manufacturer*: Metropolitan-Vickers Electrical Co., Ltd.
- *Type*: Air blast in air-conditioned switch house.
- *Rupturing capacity*: 3,500 MVA.
- *Current rating*: 600 amps.

3.3kV SWITCHGEAR

- *Manufacturer*: The General Electric Co., Ltd.
- *Type*: Oil-break single bus bar metal-clad units.
- *Rupturing capacity*: 150 MVA.
- *Current rating*: 400, 800, 1200, and 2000 amps.

415 VOLT SWITCHGEAR

- *Manufacturer*: The General Electric Co., Ltd.
- *Type*: Air-break in pressed steel cubicles.
- *Rupturing capacity*: 15 MVA.
- *Current rating*: 400, 800, and 1,200 amps.

MAIN LIGHTING SWITCHBOARDS

- *Manufacturer*: The General Electric Co., Ltd.
- *Type*: Air-break in pressed steel cubicles.

- *Rupturing capacity*: 15 MVA.
- *Current rating*: 800 amps.

SUB. LIGHTING SWITCHBOARDS

- *Manufacturer*: South Wales Switchgear, Ltd.
- *Type*: Metal-clad switch-fuse panel with H.R.C. fuses.
- *Current rating*: 30, 60, and 300 amps.

LIGHTING FUSE BOARDS

- *Manufacturer*: Simplex Electric Co., Ltd.

TRANSFORMERS

- *Manufacturer*: The General Electric Co., Ltd.
- *Generator transformers (6)*:
  - *Voltage*: 11.8/132kV
  - *Capacity*: 70 MVA
- *Station transformers (2)*:
  - *Voltage*: 132/3.3kV
  - *Capacity*: 10 MVA
- *Unit transformers (6)*:
  - *Voltage*: 11.8/3.3kV
  - *Capacity*: 6 MVA
- *Unit auxiliaries transformers (6)*:
  - *Voltage*: 3,300/415 volts
  - *Capacity*: 750 KVA
- *Turbine house aux. transformers (2)*:
  - *Voltage*: 3,300/415 volts
  - *Capacity*: 500 KVA
- *Boiler house aux. transformers (4)*:
  - *Voltage*: 3,300/415 volts
  - *Capacity*: 750 KVA
- *Coal handling plants aux. transformers (2)*:
  - *Voltage*: 3,300/415 volts
  - *Capacity*: 750 KVA
- *CW plant aux. transformers (2)*:

    - *Voltage*: 3,300/415 volts
    - *Capacity*: 500 KVA
- *Lighting transformers (2)*:
    - *Voltage*: 3,300/415/230/415/230V
    - *Capacity*: 300 + 300 KVA
- *CW pump rectifier transformers (8)*:
    - *Voltage*: 3,300/690 volts (phase to neutral)
    - *Capacity*: 1204 KVA
- *Boiler draught plant rectifier transformers (12)*:
    - *Voltage*: 3,300/555 + 555 (phase to neutral)
    - *Capacity*: 740/333 KVA

REACTORS

- *Manufacturer*: Hackbridge & Hewittic Electric Co., Ltd.
- *Type*: 132kV oil immersed naturally cooled.
- *Rating*: 18% at 90 MVA.
- *Number*: Three single-phase units.

GENERAL

- *Temperature of feed water*: 385°F.
- *Estimated steam consumption*: 8.424 lb per kWh.
- *Estimated coal consumption*: 0.99 lb per kWh.
- *Feed water make-up, quantity*: 4%, 12,000 galls/hr.
- *Town's water storage capacity*: 370,000 galls.

LIST OF MAIN CONTRACTORS NOT MENTIONED IN CIVIL AND PLANT DETAILS SECTION

1. **Foundations and Superstructure:**
    - John Morgan (Builders) Ltd.
2. **Windows and Window Operating Gear:**
    - Henry Hope & Sons Ltd.
3. **Ornamental Artificial Stone Work:**
    - Empire Stone Company Ltd.
4. **Painting Works:**
    - Ian Williams & Co.

5. **Internal Plastering:**
    - Plasterers (Liverpool & Chester) Ltd.
6. **Plumbing Services:**
    - Arthur Scull & Son Ltd.
7. **Chimney Structures:**
    - Tileman & Co. Ltd.
8. **Roofing Asphalt:**
    - The General Asphalte Co. Ltd.
9. **"Crete-o-lux" Roof Lights:**
    - Haywards Ltd.
10. **Heating Services:**
    - Norris Warming Co. Ltd.
11. **Glazing:**
    - Faulkner Green & Co. Ltd.
12. **Granolithic Flooring:**
    - Johnson Floor Ltd.
13. **Bison Floor Units:**
    - Concrete Ltd.
14. **Roof Ventilators:**
    - The Robinson Building Services Ltd.
15. **Flooring and Staircases:**
    - F. A. Norris & Co. Ltd.
16. **Decorative Painting:**
    - Stic B. Paint Sales Ltd.
17. **Sanitary Ware and Wall Tiling:**
    - Wiggins-Sankey Ltd.
18. **Paint Suppliers:**
    - Robert Bowran Ltd.
19. **Pump House Caisson, Substructure, and Superstructure:**
    - Holloway Bros. (London) Ltd.
20. **Structural Steelwork:**
    - Braithwaite & Co. Structural Ltd.
21. **Railway Sidings to Main Line:**
    - British Railways (Western Region)
22. **Site Railway Sidings:**
    - Isca Foundry Co. Ltd.
23. **Reinforced Concrete Casing for Electrostatic Precipitators:**

- J. L. Kier & Co. Ltd.

24. **Draught Plant:**
    - James Howden & Co. (Land) Ltd.
25. **Steam and Feed Pipe Work:**
    - Aiton & Co, Ltd.
26. **High-Pressure Steam Valves:**
    - Hopkinsons Ltd.
27. **High-Pressure Feed Valves:**
    - Dewrance & Co. Ltd.
28. **Boiler Automatic Control Equipment:**
    - George Kent Ltd.
29. **Thermal Insulation:**
    - Versil Ltd., and The Darlington Insulation Co. Ltd.
30. **Main Auxiliary and Multi-Core Cables:**
    - Pirelli-General Cable Works Ltd.
31. **C.W. Valves:**
    - Glenfield & Kennedy Ltd.
32. **C.W. Screens:**
    - F. W. Brackett & Co. Ltd.
33. **Pump House Internal Structural Steelwork, Galleries, and Ladders:**
    - Allan Kennedy & Co. Ltd.
34. **Station Lighting Plug Points and Internal Communications:**
    - London Electricity Board.
35. **132 kV Switch House 110V and 50V Batteries:**
    - Pritchett & Gold & E.P.S. Co. Ltd.
36. **Main Station 240V and 110V Batteries:**
    - Chloride Batteries Ltd.
37. **Shunting Locomotives:**
    - Peckett & Sons Ltd.
38. **Bulldozers:**
    - J. Fowler & Co. (Leeds) Ltd.
39. **Main Station Air Compressor:**
    - Broom & Wade Ltd.
40. **Transmission:**
    - Balfour, Beatty & Co. Ltd.

BRITISH ELECTRICITY AUTHORITY *South Wales Division*

- **H. J. BENNETT, A.M.I.E.E.** Divisional Controller
- **E. HYWEL JONES, M.I.E.E., M.I.Mech.E.** Chief Generation Engineer (Operation)
- **R. L. AXFORD, A.M.I.Mech.E** Generation Engineer (Operation)
- **W. LLOYD WILLIAMS, A.M.I.E.E, A.M.Inst.F.** Station Superintendent, Uskmouth
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- **C. MORLEY NEW. A.M.I.E.E.** Transmission Engineer
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- **E. J. TURNER** Secretary

Printed for the British Electricity Authority, British Electricity House, Trafalgar Buildings, 1, Charing Cross, London, S.W.I, by The Haycock Press Ltd., London, S.E.5