

## **37 THERMAL POWER PLANTS**

### **Thermal Power Generation**

This process involves the generation of electricity from the burning of fossil fuel in a large industrial furnace. In very simple terms, in a coal-fired station (Figure 1) the coal is pulverized and blown into the furnace where it burns, much like a gas flame, to heat water and generate steam, which moves at high speed to a turbine. The turbine spins and drives a rotor attached to a magnet in a generator. The rotating magnetic fields moving across coils in the generator produce electric currents.

The thermal machines used to convert the stored energy in the fuels to the kinetic energy of the rotor are complex units. Each consists of two principal parts: boilers and turbines. They also include a variety of auxiliary equipment to provide fuel and water to the unit and to eliminate waste gases and products of combustion.

The basic operations are mechanical and highly automated. In a coal-fired power station, where boilers and turbines are combined, there is automatic control of coal pulverization, of supplied water and fuel, of combustion, and of superheating. The elimination of ash in the auxiliary processes is also automated.

### **Plants Fired by Fossil Fuel**

Most construction, repair, and maintenance work is done during unit shutdowns or periods of extensive rehabilitation. This could involve working on one of the following system components:

- steam drum
- primary steam piping
- boiler feedwater
- superheater
- reheater
- economizer
- downcomers
- feeder and riser tubes
- waterwalls
- boiler hanger rods
- mud drum
- boiler casing
- condensate system
- electrostatic precipitators
- sulphur dioxide scrubbers
- stacks.

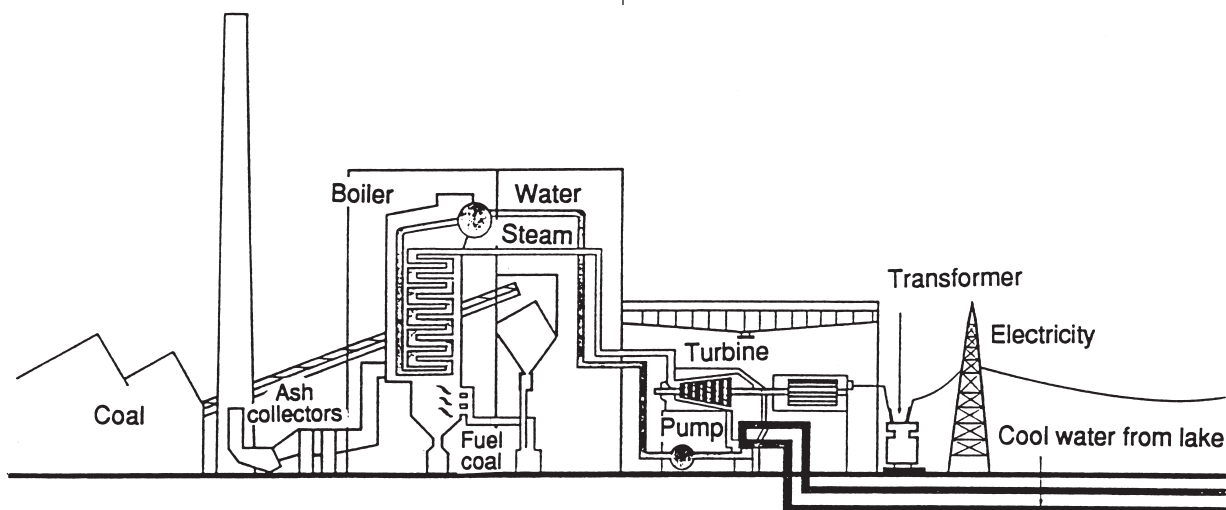


Figure 1 – Thermal (Coal-Fired) Generating Station

The sources of energy created by normal boiler operation are not usually present during major reconstruction work. However, units adjacent to the shutdown unit are usually running, which can cause other hazards such as heat and noise.

### **Common Hazards of Shutdown and Rehabilitation Work**

#### **1) Conventional Construction Hazards**

- falls, either people falling or things falling on people
- electrical contact – see proximity requirements to work around overhead powerlines
- working on or near live equipment – workers who are asked to work on or near energized equipment (regardless of the energy source) must comply with plant requirements to be applied in all work situations where systems are to be deenergized and locked out by devices such as switches or valves
- rigging and hoisting hazards
- site-specific hazards — to be identified by the plant representative.

#### **2) Industrial Hygiene Hazards**

##### **Chemical Hazards**

Before work begins, crews should receive training in the hazards existing in the work area and obtain and review the Material Safety Data Sheets (MSDSs) for any hazardous materials to which they may be exposed. These should be readily available from the facility and, in fact, should be obtained by contractors and subcontractors at the time of bidding to facilitate job planning. Any protective equipment used should at least equal that worn by plant personnel in the area. See Table 1.

##### **Reported Health Problems**

Some workers in boiler rooms may suffer from diseases of the upper respiratory tract such as bronchitis, and from conjunctivitis caused by vanadium compounds (dust given off by oil combustion) and SO<sub>2</sub>.

Table 1 – Hazardous Substances

Substance	Characteristics and Dominant Hazard
Asbestos	<ul style="list-style-type: none"> <li>– Designated substance under construction regulations</li> <li>– Diseases include asbestosis and cancer. See chapter on asbestos in this manual.</li> </ul>
Lead	<ul style="list-style-type: none"> <li>– Designated substance under industrial regulations</li> <li>– Can cause kidney and brain damage</li> </ul>
Fly ash	<ul style="list-style-type: none"> <li>– Coal ash contains oxides of silica, aluminum, and iron, with traces of manganese, lime, sodium, and unburnt fuel (carbon). Also identified are trace elements such as arsenic and selenium</li> <li>– Oil ash can contain pentoxide, other vanadium oxides, and soluble nickel compounds</li> <li>– Respiratory tract irritation, dermatitis, and possible eczema with extended skin contact</li> </ul>
Silica	<ul style="list-style-type: none"> <li>– Designated substance under industrial regulations</li> <li>– Can cause silicosis</li> </ul>
Carbon monoxide (CO)	<ul style="list-style-type: none"> <li>– Clear, colourless, odourless, tasteless toxic gas</li> <li>– Causes drowsiness leading to death</li> </ul>
Sulphur dioxide (SO <sub>2</sub> )	<ul style="list-style-type: none"> <li>– From sulphur content in oil</li> <li>– Very irritating and corrosive gas, sulphur-like odour, forms an acid on contact with moisture</li> </ul>
Coal dust	<ul style="list-style-type: none"> <li>– In fuel supply and transport areas</li> </ul>
Welding fumes	<ul style="list-style-type: none"> <li>– Hazards vary depending on type of metal, type of welding, and coatings</li> <li>– Health effects can include metal fume fever and respiratory irritation.</li> </ul>

Flue cleaners and cinder removers may, after some years, suffer from chronic bronchitis and rhinopharyngitis as well as pneumosclerosis caused by cinder dust and sulphur dioxide and trioxide.

The residues of oil combustion are more harmful than the dust given off after the combustion of other fuels. Dermatitis can develop from ashes contacting damp skin. Eczema may result from the combined action of compounds of nickel, vanadium, and sulphuric acid present in the residues.

### 3) Other Health Hazards

For information on other health hazards, refer to the chapters on WHMIS and Basic Occupational Health in this manual. One controversial topic is the potential health hazard of being in the vicinity of high electromagnetic fields in thermal generating plants. This concern should be monitored for future information.