

GOVERNMENT OF TELANGANA
DIRECTORATE OF FACTORIES

SAFETY ALERT

COAL-BASED THERMAL POWER PLANTS
Comprehensive Hazard Identification & Safety Control Measures

Alert No.: SA-9/2026	Issued: June 2026	Sector: Power / Utilities
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1. Purpose & Scope

Coal-based Thermal Power Plants (CTPPs) involve complex, high-energy processes that present multi-layered occupational safety and process safety hazards. This Safety Alert is issued by the Directorate of Factories, Government of Telangana, to communicate critical hazards and mandatory preventive measures across all major operational areas of CTPPs.

2. Coal Storage Yard

Open-cast coal storage yards handle millions of metric tonnes annually. Spontaneous combustion, stockpile collapse, and vehicular hazards are the primary risks.

Key Hazards & Controls – Coal Storage	
➤	Spontaneous combustion of coal stockpiles — monitor stockpile temperature regularly using thermocouples; keep stack height ≤ 9 m; compact stockpiles to restrict air ingress; maintain CO monitoring systems.
➤	Methane and toxic gas accumulation in enclosed or confined areas of coal yards — conduct periodic gas testing; prohibit open flame near stockpiles; maintain minimum 30 m clearance from ignition sources.
➤	Dust explosion risk — install coal dust suppression systems (water sprays/foam); enforce no-smoking zones; bond and earth all metallic structures.
➤	Slope failure / stockpile collapse — maintain safe angle of repose (≤ 37°); erect slope stability barriers; prohibit workers from standing beneath overhanging coal banks.
➤	Heavy equipment (dumpers, dozers) hazards — enforce segregated pedestrian routes; ensure ROPS(Roll Over Protective Structure /FOPS(Falling Objective Protective Structure) fitted on all mobile plant; mandatory banksman for reversing vehicles.
➤	Flooding / water logging — install adequate drainage; monitor water table near storage areas; avoid coal storage in flood-prone zones without bund protection.
➤	Spontaneous fire response — keep sand, DCP extinguishers, and hydrant points at strategic locations; develop a Stockpile Fire Contingency Plan.

3. Stacker & Reclaimer Operations

Stackers and reclaimers are large rail-mounted machines susceptible to structural, mechanical, electrical, and entrapment hazards.

Key Hazards & Controls – Stacker / Reclaimer	
➤	Entrapment in moving machinery — install interlocked guards on all rotating parts; enforce LOTO/LOCKOUT-TAGOUT before any maintenance; permit-to-work (PTW) system mandatory.
➤	Structural overload and derailment — observe rated capacity limits; conduct monthly inspection of rail tracks and buffer stops; check boom structural integrity quarterly.
➤	Electrical hazards (3.3 kV / 6.6 kV trailing cables) — periodic insulation resistance testing of trailing cables; cable reeling drum inspection; earthing continuity verification.
➤	Falls from height on stacker boom / maintenance platforms — provide full body harness anchor points; install toe boards and mid-rails on walkways; prohibit work during high winds (> 50 km/h).
➤	Collision during slewing/luffing operations — enforce radio communication protocol between operator and ground crew; install proximity warning devices; demarcate swing zones.
➤	Storm / lightning risk — install lightning protection on stacker boom; park machine in stowed position during thunderstorms; earthing verification after lightning events.

4. Belt Conveyors

Belt conveyors are among the highest injury-causing equipment in CTPPs. Nip points, belt sag, spillage, and fire present constant risks.

Hazard / Risk	Preventive / Control Measure
Entrapment / entanglement at nip points (drive pulley, tail pulley, snub pulley)	Fixed guards at all nip points; emergency pull-cord switches at ≤ 25 m intervals; LOTO before maintenance; never ride or cross a running belt.
Belt fire due to friction / coal build-up	Automatic fire detection (heat/smoke) and suppression along belt; belt slip/tear detection switches; regular belt cleaning scrapers; no smoking within 15 m.
Coal spillage creating slip/trip/dust hazards	Install proper skirt boards and sealing at transfer points; schedule regular spillage clearance; housekeeping SOP to be followed strictly.
Workers walking / working beneath elevated conveyors	Install drip trays; barricade beneath elevated portions; wear helmets; prohibit access during operation unless essential with PTW.
Conveyor gallery fire spread	Fire doors between gallery sections; automatic suppression system; emergency stop accessible from both ends of gallery; monthly fire drill.
Structural failure of conveyor galleries	Periodic structural audit; corrosion monitoring; load tests after modifications; compliance with relevant Indian Standards.

5. Coal Crusher & Crusher Shed

Coal crushers (ring granulators / hammer mills) handle high-tonnage coal with severe mechanical, noise, and dust hazards. The enclosed crusher shed intensifies exposure.

Key Hazards & Controls – Crusher & Crusher Shed	
➤	High noise levels (> 95 dB(A)) — install acoustic enclosures or damping panels; enforce mandatory hearing protection (ear muffs, EN 352-1 standard); audiometric testing annually.

➤	Coal dust inhalation (respirable fraction) — install LEV (Local Exhaust Ventilation) at feed and discharge points; provide half-face respirators; conduct air monitoring
➤	Dust explosion in enclosed crusher shed — anti-static equipment bonding; continuous methane/CO monitoring; no-spark tool policy; explosion-relief panels on shed walls.
➤	Mechanical contact with crusher rotor — install interlock-guarded inspection doors; mandatory LOTO with multiple hasps for multi-employee isolation; visual 'machine stopped' indicator before access.
➤	Tramp metal causing projectiles — install magnetic separators and metal detectors upstream of crusher; regular inspection of feed chute for foreign objects.
➤	Vibration from crusher propagating to structure — conduct annual vibration monitoring on support structure; check anti-vibration mounts; restrict personnel from adjacent rooms during operation.
➤	Housekeeping and slipping hazards — daily water/vacuum cleaning of coal fines; non-slip flooring surfaces; adequate lighting

6. Coal Mill (Pulveriser)

Coal mills pulverise coal to fine powder (< 75 micron) mixed with hot primary air — creating a highly explosive pulverised coal-air mixture (PCI). Explosion prevention is the overriding safety priority.

Key Hazards & Controls – Coal Mill	
➤	Pulverised coal dust explosion — maintain coal-air ratio within design limits; install explosion suppression / isolation valves; fit explosion relief doors rated to 10 kPa; no hot work within 10 m of operating mill.
➤	Coal mill fire (smouldering in pulveriser body) — continuous CO monitoring at mill outlet; CO > 200 ppm triggers immediate shutdown and inertisation (N ₂ / CO ₂ injection); never open mill suspected to contain fire.
➤	Primary air fan reversal on mill trip — interlock PA fan with mill; verify damper interlock before restart; conduct operational PTW for mill isolation.
➤	Pyrite rejection box — pyrites accumulate at mill base and can self-ignite; remove pyrites at regular intervals; keep pyrite box cool with water spray; never allow pyrite accumulation beyond 24 hours.
➤	Hot primary air (> 300°C) burns — thermal insulation of all primary air ducting; colour-code hot surfaces (orange); mandatory heat-resistant PPE for maintenance near primary air system.
➤	High vibration leading to mechanical failure — vibration monitoring of mill journal bearings; predictive maintenance schedule; shut down at vibration > 10 mm/s RMS.
➤	Coal spillage from mill seals — regular inspection of mill door seals; collect and safely dispose of spilled coal; prevent accumulation near hot surfaces.

7. Boiler & Furnace

Power boilers (subcritical / supercritical) operating at pressures of 150–250 kg/cm² and temperatures up to 600°C represent the highest-consequence equipment in a CTPP.

Hazard / Risk	Preventive / Control Measure
Boiler explosion due to pressure excursion	IBR-certified safety valves; calibrated pressure gauges; SIL-rated BPCS and SIS; boiler water level monitoring; no bypass of safety interlocks.

Hazard / Risk	Preventive / Control Measure
Furnace explosion (unburnt fuel ignition)	Purge furnace for min. 5 min (>5 air changes) before lighting up; verify igniter flame scanners; follow OEM light-up sequence strictly; train operators on emergency shutdown SOP.
Tube failure / steam blowback	Annual IBR inspection; online tube thickness monitoring using UT; monitor flue gas temperature deviation; install blow-back deflector shields at soot blower positions.
High-temperature burns from steam / hot water leaks	Steam trap inspection programme; insulate steam lines to < 50°C surface temperature; issue Hot Work PTW for steam system maintenance; use vapour-proof gloves and face shields.
Falls inside boiler (during shutdown / cold maintenance)	Pre-entry oxygen test (> 19.5%); confined space PTW; full harness with lifeline; buddy system; rescue plan before entry.
Ash clinker fall from furnace walls	Prohibit personnel below furnace during soot blowing; wear helmet and face shield; install telescopic de-ashing tools; never poke furnace walls manually.

8. Steam Turbine & Generator

Key Hazards & Controls – Turbine	
➤	Turbine blade failure (destructive burst) — online vibration monitoring (bently nevada type); axial shift and differential expansion alarms; overspeed trip testing per OEM schedule; never bypass overspeed protection.
➤	Lube oil fire — oil temperature alarm / high-high interlock to trip; automatic foam suppression in lube oil area; fire walls between lube oil tank and hot surfaces; oil-resistant cable routing.
➤	Steam leaks from turbine glands — inspect gland sealing system; use thermal imaging cameras quarterly; PPE (steam-proof gloves, face shield) for maintenance in high-pressure steam area.
➤	Hydrogen (H ₂) gas from generator cooling — refer Section 9 (Hydrogen Cooling) for specific controls.
➤	Electrical hazards (11 kV / 220 kV generator terminal area) — access restricted to authorised electrical personnel; lockout on generator circuit breaker before work; arc flash PPE (NFPA 70E Category 3/4) required.
➤	Condenser vacuum collapse leading to reverse rotation — check non-return valve on steam admission; ESV (Emergency Stop Valve) interlock verified before each startup; barring gear operation under PTW only.

9. Hydrogen (H₂) Cooling System for Generator

Hydrogen-cooled generators use high-purity hydrogen (99.9%) at up to 3 kg/cm² pressure. Hydrogen (LEL 4%, UEL 75%) is extremely flammable and forms explosive mixtures with air. This area must be treated as a HAZARDOUS AREA

Key Hazards & Controls – Hydrogen Cooling	
➤	Hydrogen fire / explosion from leaks — continuous fixed H ₂ gas detection (< 10% LEL triggers alarm; > 25% LEL triggers evacuation + emergency isolation); ATEX/IECEx certified detectors;

	use intrinsically safe tools only.
➤	H ₂ purity loss (H ₂ -air explosive mixture formation) — CO ₂ purging mandatory during H ₂ filling/draining (never allow direct air-H ₂ contact); monitor purity online; purity < 98% triggers alarm.
➤	H ₂ cylinder manifold hazards — store H ₂ cylinders in ventilated fireproof room; chain cylinders; no oil/grease contact with H ₂ fittings; weekly leak test with calibrated detector.
➤	Seal oil system failure causing H ₂ leakage — install dual seal oil pumps with auto-standby changeover; daily seal oil pressure checks; differential pressure alarms across seals.
➤	Static electricity ignition — bond all H ₂ pipework to earth; use anti-static footwear in H ₂ handling areas; restrict synthetic clothing near generator casing.
➤	Hydrogen asphyxiation in generator pit — continuous O ₂ monitoring in enclosed spaces near generator; min O ₂ 19.5% for entry; ventilate before maintenance; buddy system mandatory.
➤	No Ignition Sources policy — 'No smoking / No open flame' zone within 30 m of generator; hot work PTW mandatory; eliminate all non-flame proof equipment from Zone 1.

10. Chlorine Handling – Water Treatment Plant (WTP)

Chlorine (Cl₂) is a Schedule 1 Toxic Substance under MSIHC Rules 1989. Even small leaks can cause serious injury. Chlorination systems in CTPPs typically use 900 kg cylinders or tonner containers.

Hazard / Risk	Preventive / Control Measure
Cl ₂ cylinder/tonner leak — Toxic Gas Release (TLV-C: 1 ppm)	Fixed electrochemical Cl ₂ gas detectors at tonner room; alarm at 0.5 ppm, evacuation at 1 ppm; SCBA (30 min rated) kept outside chlorine room; emergency shower and eyewash within 10 m.
Chlorine tonner collapse or valve damage	Use approved tonner trolley; never drag cylinders; fit valve protection caps; institute 2-person rule for tonner movement; check for cracks before use.
Inadequate ventilation in chlorine room	Forced exhaust ventilation (12 ACH minimum) with discharge above building roof; NaOH scrubber on exhaust; power failure activates emergency battery fan.
Cl ₂ over-dosing to water system	Residual Cl ₂ analyser on treated water; automatic shut-off valve; daily calibration of chlorinators; log all dosing rates.
Emergency response gap	On-site Cl ₂ Emergency Response Plan; trained first responders; mutual aid agreement with nearby plant/hospital; rehearse Cl ₂ mock drill biannually; TOST (Toxic On-site Treatment) protocol as per MSIHC.
Chemical incompatibility (Cl ₂ + ammonia / hydrocarbons)	Segregate chlorine storage from ammonia, fuel, and flammable chemicals by > 15 m; NO storage of incompatibles in same room.

11. Demineralisation (DM) Plant & Acid/Alkali Storage

DM plants use Hydrochloric Acid (HCl), Sulphuric Acid (H₂SO₄), and Caustic Soda (NaOH) for ion-exchange regeneration. These are Schedule chemicals under MSIHC Rules requiring hazardous substance management.

Key Hazards & Controls – DM Plant & Acid Storage	
➤	Acid/alkali spill causing chemical burns — all acid/alkali pipelines to be double-contained or in bunded areas; acid-resistant flooring; emergency shower and eyewash within 10 m of every chemical handling point; SOP for spill response.
➤	HCl fumes (TLV-C: 2 ppm) causing respiratory damage — local exhaust ventilation at unloading points; sealed transfer system; acid-resistant PPE (face shield, nitrile gloves, PVC apron) mandatory during handling.
➤	H ₂ SO ₄ exothermic reaction with water causing splashing burns — never add water to acid; use dilution vessels with cooling; store H ₂ SO ₄ away from water sources; display mixing SOP at unloading bay.
➤	Acid storage tank overflow — high-level alarm and automatic shut-off valve on storage tanks; secondary containment bund capacity ≥ 110% of tank volume; daily level monitoring log.
➤	HCl and NaOH incompatibility — segregate acid and alkali storage areas; colour-code pipelines (HCl: yellow; NaOH: violet; H ₂ SO ₄ : orange); anti-siphon valves on transfer lines.
➤	Resin bed fire in exhausted ion-exchange columns — never allow oxidising agents near ion-exchange resins; periodic resin quality testing; housekeeping around vessel flanges.
➤	Vehicle tanker unloading hazard — trained chemical transfer operator; earthing/bonding of tanker; check delivery note and tanker manifest before unloading; restrict other traffic during unloading.

12. Fire Prevention & Control

CTPPs are high fire-load facilities with coal, oil (lube, fuel), hydrogen, transformer oil, and cable insulation all presenting ignition risks. A site-wide Fire Safety Management Plan (FSMP) compliant with the National Building Code (NBC) 2016 Part 4 and IS 2190 is mandatory.

Hazard / Risk	Preventive / Control Measure
Cable gallery / cable cellar fire	Install automatic cable fire suppression (CO ₂ / water mist); fire-retardant cable; fire-stop seals at every wall penetration; thermal imaging survey annually.
Transformer fire (oil-immersed main/unit transformers)	Oil-filled transformer to have buchholz relay, OTI (Oil Temperature Indicator)/WTI (Wiring Temperature Indicator) with trip; oil containment pit; automatic CO ₂ or water spray protection; explosion-proof walls around power transformers.
Fuel oil / lube oil fire in turbine hall	Install oil mist detectors; foam suppression system in lube oil bay; no hot work in oil fire zone without PTW; fire dampers in HVAC at turbine hall boundaries.
Emergency access blockage	Maintain 4 m clear fire-fighting access around all buildings; fire road free from parking; gate-in/gate-out system for all vehicles.
inadequate firefighting resources	Dedicated fire station on site with 2 tenders minimum; 24-hour fire watch; 4-hour capacity water reservoir; monthly mock drills; tie-up with State Fire Service.
Hot Work without control	PTW mandatory for all grinding, welding, cutting operations; fire watch for 30 min after completion; CO ₂ / DCP extinguisher at work site; clearance certificate before PTW closure.

13. Occupational Health

Coal-based TPPs generate occupational health risks including pneumoconiosis (black lung), hearing loss, heat stress, and chemical toxicity.

Occupational Health Provisions	
➤	Coal Dust / Silica exposure (CWP / Pneumoconiosis) — conduct quarterly respirable dust and silica monitoring (IS 5182 Part 3); ensure TWA < 1 mg/m ³ (respirable coal dust); provision of N95/P100 respirators; pre-placement and annual chest X-ray (ILO classification).
➤	Noise-Induced Hearing Loss (NIHL) — implement hearing conservation programme (IS 11690); engineering noise controls first; audiometric testing every 12 months; restrict exposure time as per standards
➤	Heat Stress in boiler area / summer outdoor work — wet bulb globe temperature (WBGT) monitoring; mandatory rest-work schedule at WBGT > 28°C; cool water and ORS provision; acclimatisation programme for new workers.
➤	Chlorine / acid / alkali chemical exposure — biological monitoring for workers handling HCl; liver function, renal function tests annually; spirometry for workers in DM plant; maintain MSDSs accessible at all chemical storage points.
➤	Musculoskeletal hazards in maintenance — ergonomic assessment for repetitive manual handling tasks; mechanical lifting aids (hoists, conveyors) for loads > 25 kg; conduct RULA (Rapid Upper Limb Assessment) and REBA (Rapid Entire Body Assessment) for coal yard and maintenance workers.
➤	Pre-employment and periodic medical examination —engage a registered occupational physician

14. Ash Handling System

Coal ash (fly ash and bottom ash) are generated in large volumes. Fly ash is a carcinogen suspect; silica content requires Silicosis prevention protocols. Ash disposal must comply with MoEFCC Fly Ash Notification.

Key Hazards & Controls – Ash Handling	
➤	Fly ash inhalation (silicosis risk) — online PM monitoring at ESP outlet and ash silos; FFP3 respirators during manual interventions; wet suppression during ash handling; health surveillance for all ash handling workers.
➤	Electrostatic Precipitator (ESP) high-voltage hazards (40–75 kV DC) — mandatory LOTO before internal ESP access; capacitor discharge verification before entry; access control with key-interlocked system; warning signage
➤	Bottom ash hopper burns from hot ash — cool hopper before manual intervention; pyrometer check before opening; steam release SOP at hopper opening; heat-resistant PPE for ash pit workers.
➤	Ash silo collapse / overflow — structural audit of fly ash silos; high-level alarm and auto shut-off; silo pressure monitoring; quarterly inspection of cone section; OSHA silo entry permit.
➤	Ash slurry pipeline failure — quarterly UT thickness inspection on slurry lines; pressure relief valves on slurry pumps; dyke walls along slurry pipelines; spill response plan for ash pond emergency.
➤	Ash pond dam breach — comply with relevant statutory guidelines; bi-annual dam safety inspection; emergency action plan (EAP) for dam failure; water balance monitoring; freeboard maintenance ≥ 0.5 m.
➤	Spontaneous warming of ash — monitor ash disposal areas for temperature rise; prohibit vehicle

movement on hot ash; CO alarm at ash silo outlets.
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15. Coal Bunkers

Coal bunkers are elevated enclosed structures that store crushed coal (typically 500–2000 T capacity) above the coal mill floor. They are confined spaces with CO and methane accumulation risks.

Key Hazards & Controls – Coal Bunkers	
➤	Coal bunker fire (spontaneous combustion / hot spot) — continuous CO monitoring inside bunkers; CO > 50 ppm triggers investigation; CO > 200 ppm triggers emergency inertisation (N ₂ injection) and controlled drawdown.
➤	Confined space hazards — coal bunkers classified as 'Permit Required Confined Spaces' (PRCS); pre-entry atmospheric testing (O ₂ , CO, CH ₄ , H ₂ S); SCBA standby team outside; mechanical ventilation; rescue plan.
➤	Bunker bridging (coal hang-up) — never use oxygen lancing or explosives; use vibrators or approved mechanical rapping; operator to stand clear of bunker outlet during rapping; SOP display at each bunker.
➤	Inrush of coal during de-bridging — rope-off area below bunker outlet; no worker to enter hopper section; use telescopic rods from above; stop mill feeder before rapping.
➤	Structural fatigue of coal bunker supports — annual structural inspection; no overloading beyond rated capacity; monitor for cracks in concrete supports; vibration monitoring at bunker columns.
➤	Fall into coal bunker — top-opening of bunkers to have interlocked grating; harness anchor points; 'bunker grating open' alarm; buddy system for inspection tasks.

16. Ash Bunkers (Fly Ash Silos)

Key Hazards & Controls – Ash Bunkers / Silos	
➤	Fly ash inhalation during silo venting / truck loading — install vent filter bags (BHA/Goretex) on silo tops; enclosed loading spouts with dust extraction; PPE: FFP3 respirator, coveralls, goggles.
➤	Silo entry for cleaning — confined space PTW; atmospheric test for O ₂ deficiency (fine ash can displace O ₂); mechanical ventilation; safety harness and tripod/winch for retrieval.
➤	Pressurisation hazard (pneumatic conveying system) — pressure relief valves on silos; fluidising air flow alarms; auto-isolation of air supply before silo entry; never enter silo under pressure.
➤	Ash compaction leading to sudden uncontrolled discharge — install roto-flow (level sensors) and vibrators; controlled drawdown procedures; personnel kept clear of silo cone outlet during discharge.
➤	Silo structural failure — comply with relevant Indian Standards for silo design; periodic non-destructive testing (NDT) of welded joints; re-inspection after seismic events; no external attachments without structural clearance.

Issued in the interest of Industrial Safety and Prevention of Accidents. The above advisory is to create awareness on safety systems. This will not absolve the responsibility of managements to comply with statutory norms under relevant statutory provisions-

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