

SAFETY GUIDELINES FOR IRON & STEEL SECTOR		
MINISTRY OF STEEL, GOVT. OF INDIA	COKE OVENS, COKE DRY COOLING PLANT (CDCP) & BY PRODUCT PLANT	Doc. No: SG/28
		Rev no. : 00 Effective Date: --

1. OBJECTIVE:

The main function of Coke Ovens is to convert coal into coke which is used as a fuel and reducing agent in the Blast Furnace. Its secondary function is to recover Volatile Matter and CO (Coke Oven) gas from coal and extract chemicals known as Coal Chemicals. CO gas produced is used for heating purposes in the plant. Heat from hot coke is extracted & steam is generated at Coke Dry Cooling Plant (CDCP) for production/ generation of power/ electricity.

This entire process of coke making is associated with various safety hazards like hit / entanglement with mobile equipment, burns, fire and explosion, slip & fall, exposure to dust, noise, heat & gas etc. Most health hazards in coke production arise from the emissions that take place during coal charging, coal carbonization, coke pushing & coke cooling. Coke oven emissions contain cancer-causing polynuclear aromatic hydrocarbons, along with toxic gases and vapours such as benzene, hydrogen sulphide, carbon monoxide, ammonia etc.

2. SCOPE:

This recommended guideline is applicable to Coke Ovens, Coke Dry Cooling Plant & By-product department of an Integrated Steel Plant.

3. PROCESS BRIEF :

The Coke Ovens, By-Product Plant & Coke Dry Cooling Plant (CDCP) has following main sections:

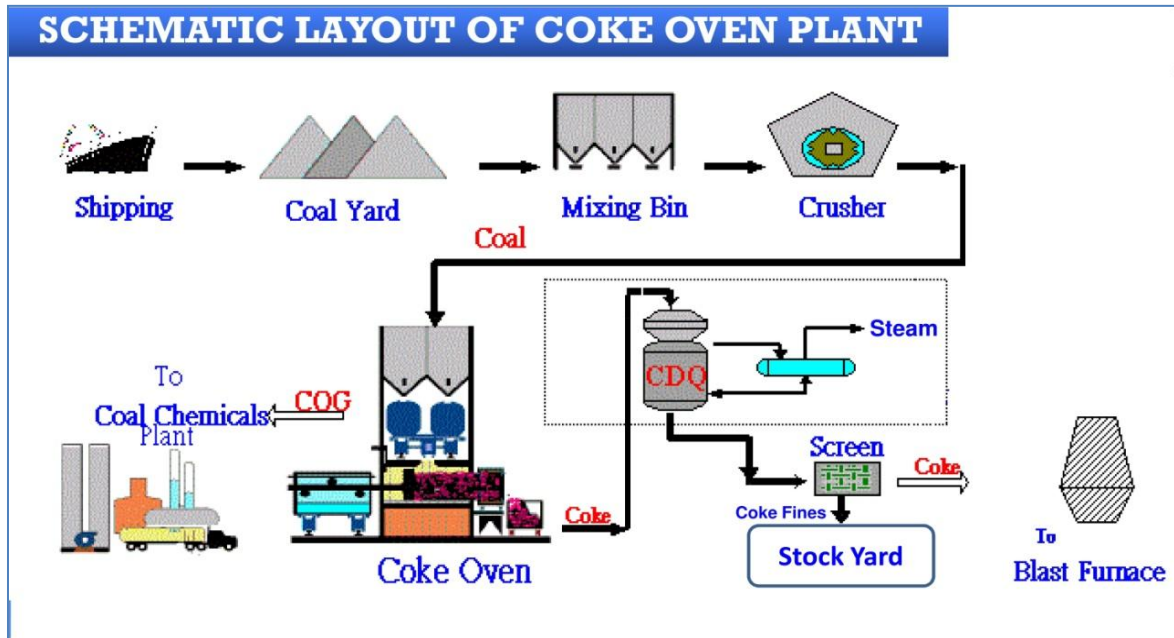
i. COKE OVENS:

Various sub-sections of Coke Ovens complex and their functions are as follows:

- a) **Coal Handling Plant:** To prepare coal blend suitable for carbonisation in Coke Ovens batteries to produce BF coke.
- b) **Coke Oven Batteries:** To convert coal into coke by carbonising coal in absence of air and thereby distilling the volatile matter out of coal. The resultant coke oven gas is treated in CCD (By Product Plant) for recovery of chemicals and thereby clean the gas. This includes Charging of coal, Pushing of coke and Dry/Wet Quenching of coke, etc.

- c) **Coke Sorting Plant:** To crush and screen coke to 25-80 mm size required by blast furnaces. The 0-10 mm fraction is used in sinter making and 10-25 mm fraction (nut coke) is added along with sinter supplied to Blast Furnace.

The above process is narrated below schematically in a simplified way



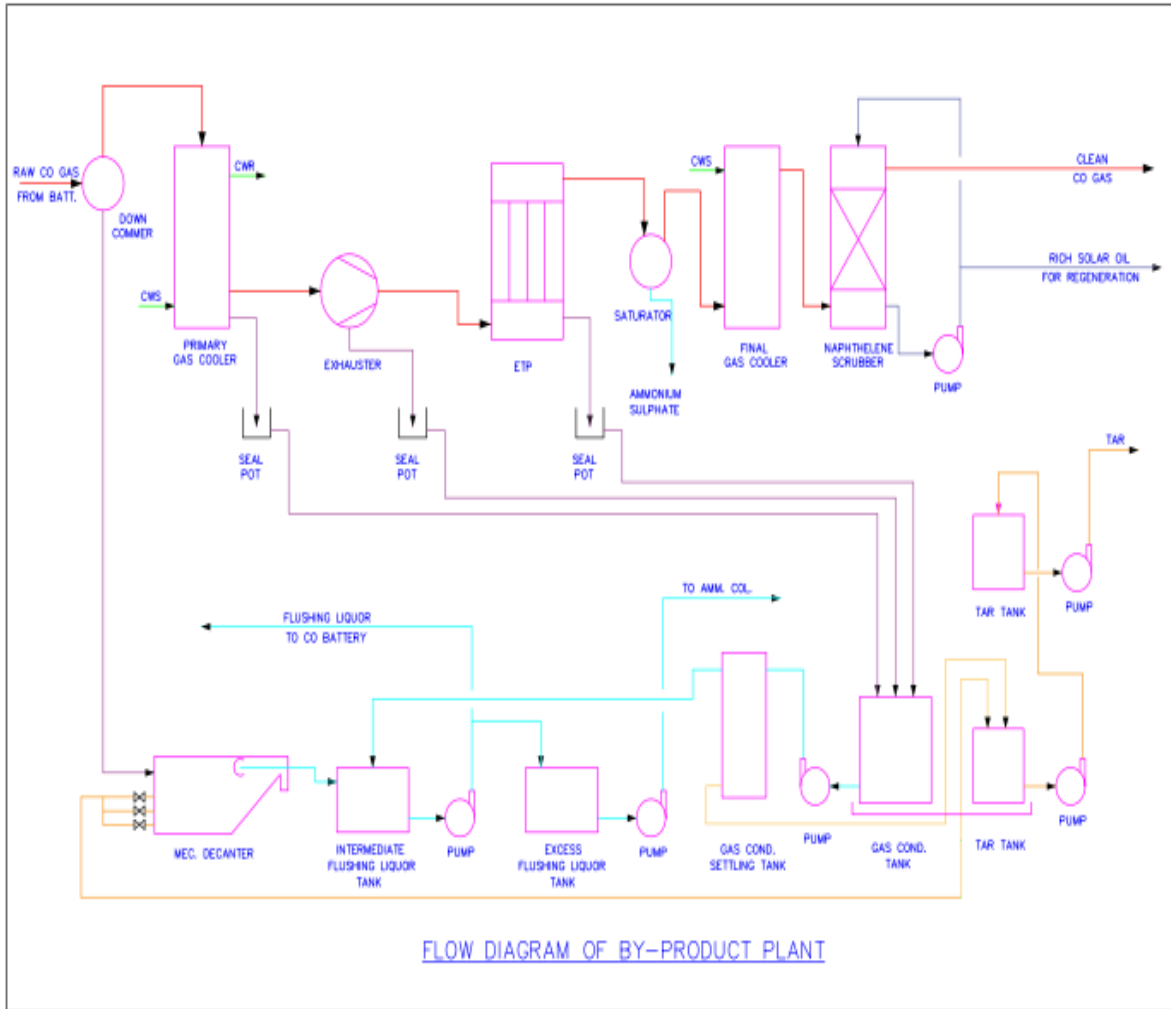
ii. **COAL CHEMICALS / BY-PRODUCT SECTION:**

The coke oven gas coming out from batteries contains valuable chemicals like tar, ammonia and benzol. These chemicals are recovered and gas is cleaned in the by-product plant which is subsequently used as fuel gas in the process.

This plant comprises of the following sections:-

- a) Gas Condensation section
- b) Ammonium Sulphate Plant
- c) Benzol Recovery section
- d) Benzol Rectification Plant
- e) Tar Distillation Plant
- f) Sulphuric Acid Plant

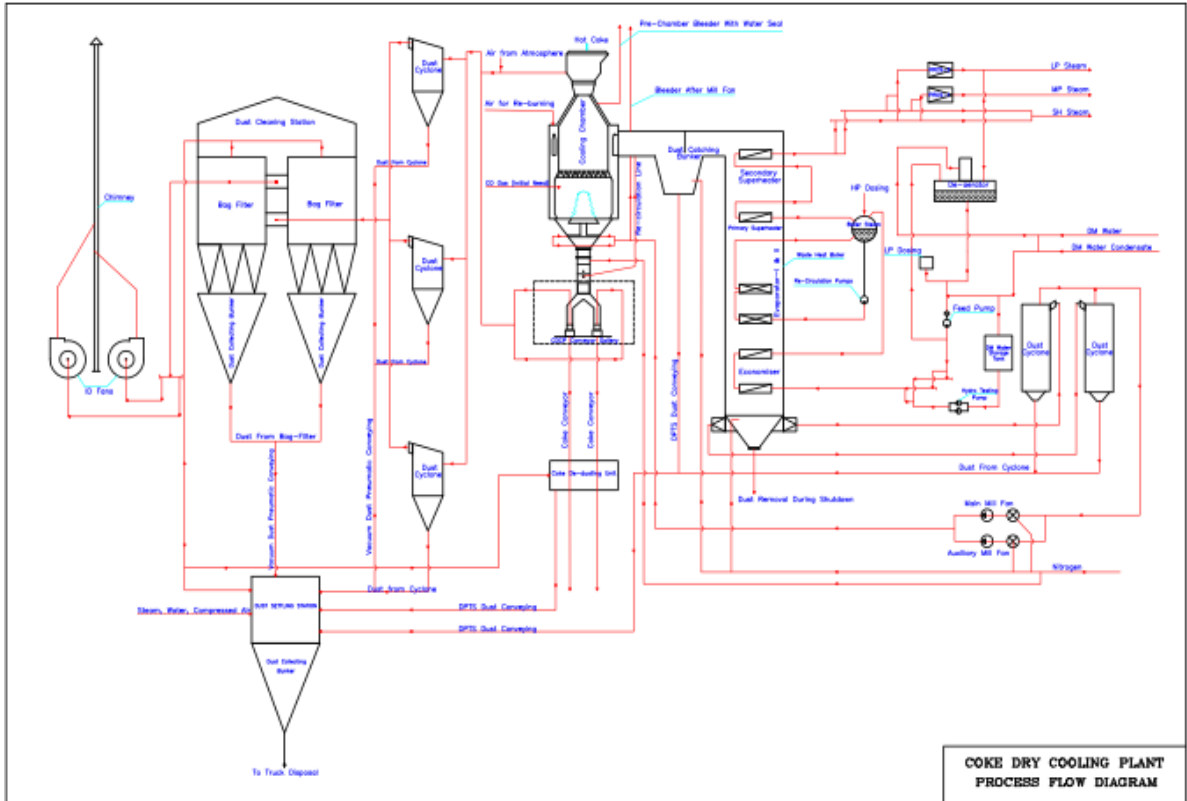
A schematic flow diagram of a typical By-product plant is given below:



iii. COKE DRY COOLING PLANT:

Hot coke produced in Coke Oven Battery is fed in the CDCP chamber at the top. In the CDCP, hot coke from Coke Oven at a temperature of around 1050 °C is cooled down to cold coke of temperature less than 200 °C. The heat extracted from hot coke is utilized in Waste Heat Boilers to generate High Pressure Steam (temperature 500 °C / 440 °C & pressure 66 Kg/cm² / 40 Kg/cm²) for power generation. Temperature and pressure of generated steam will be selected based on the client's requirement to have integration with their existing systems.

Refer below a typical schematic diagram of a Coke Dry Cooling Plant:



Some of critical Equipments/ facilities in Coke Oven, By product Department & Coke Dry Cooling Plant (CDCP) are as follows:

Sl. No.	Area	Major equipments
1.	Coke Ovens	Wagon tippers, crushers (hammer/ roll crusher), conveyors, bins/ silos, screens, stackers cum reclaimers, Ovens machines like charging cars, pusher car, coke guide car, quenching cars, DFDS (Dry Fog Dust Suppression), Dust Extraction System, BOD (Biological Oxygen Demand) Plant etc.
2.	Coal Chemicals	Tar decanters, Primary coolers, Exhausters, Electrostatic Tar precipitators, Ammonia saturators, Final coolers, Benzol scrubbers, associated process & storage tanks, pipings & pumps etc.
3.	Coke Dry Cooling Plant (CDCP)	Coke Bucket Lifter, Coke Car & Electric Loco, Waste Heat Boiler, High Pressure Drum, Mill Fan & Auxiliary Mill Fan, Feed Water Pump, Re-circulating Pump, Charging Device, Discharging Device, ID Fan, Bag Filter, Coke Conveyor, Steam Ejector, High Pressure / Low Pressure Steam Piping & Valves, HP/LP Dosing System, Pressure Reducing & De-superheating System, Ventilation Fan, etc.

4.0 PROCESS HAZARD ANALYSIS & NECESSARY RISK CONTROL MEASURES:

Sl. No.	Area/Section	Hazards	Risk Control Measures
A) COKE OVEN			
1)	Coal Handling Plant	Hand getting pressed during coupling decoupling of wagons	<ul style="list-style-type: none"> ❖ Use scotch block below wagon wheel. ❖ Ensure proper communication. ❖ Use PPEs <p><i>(Refer SG-25: Safety Guideline for Loco Operation & SG-18: Personal Protective Equipment (PPE) Management)</i></p>
		People struck by moving Side arm charger	<ul style="list-style-type: none"> ❖ Unauthorized entry restricted. ❖ Alarm system. ❖ Interlock between side arm charger operation and ground working.
		Wagon rollover	<p>No movement across the track while wagons are pushed or pulled.</p> <p><i>(Refer SG-25: Safety Guideline for Loco Operation)</i></p>
		Hit during rotation of tippler	<ul style="list-style-type: none"> ❖ Siren system prior to start of rotation. ❖ No person is allowed at tippler table top during rotation. ❖ Development & adherence to SOP.
		Sudden opening/ falling of wagon doors.	<p>People are not allowed to stay or walk within 5 ft from wagon during in haul/ outhaul.</p>
		Moving Conveyor / shuttle conveyor	<ul style="list-style-type: none"> ❖ Shutdown/permit to work with electrical isolation. ❖ No work should be done on conveyor in running condition. ❖ Always operate Local emergency switch for approaching conveyor.

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<ul style="list-style-type: none"> ❖ Availability of Pull chord. ❖ Siren system prior to restarting conveyor. ❖ Loose cloths prohibited. ❖ Area barricading if material is removed from height. ❖ Head end and tail end guard. ❖ Crossing the conveyor only through the designated place. ❖ Conveyor guard throughout length of conveyor including return side. ❖ Sufficient illumination to be provided / maintained. ❖ Spillage, if any, to be cleaned regularly to avoid slippages ❖ Auto hooter blowing whenever shuttle shifting command given <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance) & SG-19: Safety Guideline on Operation and Maintenance of Conveyor Belts, SG-05: Safety Guideline for illumination at work place)</i></p>
		Rotating machineries	<p>Coupling guards to be in place. Loose cloth to be prohibited.</p> <p><i>(Refer SG-09: Safety Guideline in Equipment & machine Guarding)</i></p>
		Slip, Trip & Fall	<p>Chute opening shall be covered with grills.</p>
		Fire hazard due to self-ignition of coal and due to rubbing of conveyors/ Idlers etc.	<ul style="list-style-type: none"> ❖ Maintain housekeeping ❖ SG-16: Safety guideline for Fire Safety to be followed. ❖ No overloading. ❖ Zero speed switches to be ensured.

Sl. No.	Area/Section	Hazards	Risk Control Measures
2)	Partial Briquetting	Burn Injury due to steam and tar.	Regular inspection as per SOP/ SMP.
		Moving conveyors	SOP for Conveyor to be developed & followed. <i>(Refer SG-19: Safety Guideline on Operation and Maintenance of Conveyor Belts)</i>
3)	Coke Oven Batteries	Wrong Pushing	<ul style="list-style-type: none"> ❖ RADAR Based oven machine interlocking system to be followed. ❖ Machine interlock to be provided & maintained.
		Coke falling on person from an open door	<ul style="list-style-type: none"> ❖ Nobody should pass in front of open door. ❖ All door man should wear FR jackets. ❖ Manual frame cleaning to be done by standing in a side and not directly in front. ❖ Use coal cake Scrapper during cake breakage most of the time to clean it. (For Stamp charge) ❖ During coal cake breakage, never stand in front of oven for cake cleaning if required. (For stamp charge) ❖ Wear helmet with glass protection for face. ❖ Charging level to be maintained and levelling shall be done.
		Person hit by moving machines	<ul style="list-style-type: none"> ❖ Siren, gong bell during movement of oven machines. ❖ Auto announcement during any coke oven machine operation. ❖ Before starting a standing car long hooter should be given and operator to check

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<p>for any person doing any job.</p> <ul style="list-style-type: none"> ❖ Permit to work prior to undertaking any maintenance job. ❖ Climbing prohibited on running machine. ❖ Interlock to be provided to stop the machine if someone tries to climb on running machine. ❖ Danger lights to be provided near power trolley lines / catenary.
		<p>Hazard related to Gas of off take system.</p> <p>(Fire during closing of leveling door, Burn by flame coming out from oven, flue during movement on oven top ,Hot water falling during closing of AP lid, Flame coming out during Goose neck and AP cleaning ,Flame coming out due to liquor, exhauster or power failure.)</p>	<ul style="list-style-type: none"> ❖ Ensure exact oven is opened through oven positioning system. Confirm from oven top man about opening of HPALA valve. ❖ Stay away from flue cap and charging holes. ❖ Use FR jacket and face shield. ❖ Proper sealing of charging lids after charging should be done using refractory material. ❖ Proper pressure to be maintained for GCM. ❖ Auto opening of bleeder valve. ❖ While moving on oven top, must wear cotton hand gloves and never touch metallic parts present in this area. ❖ Safety signage to be provided about use of required PPEs at oven top. ❖ Unauthorized entry to be prevented if possible by access control.

Sl. No.	Area/Section	Hazards	Risk Control Measures
			❖ Camera to be provided, if possible.
		Running repair of ovens (Goose Neck and Isolation valve changing.	Detail job safety protocol is to be prepared to undertake the job.
		Gas Leakage and backfire in cellar and gas pipelines	<ul style="list-style-type: none"> ❖ Online CO monitors with alarm system to be installed for detecting gas leakage if any. In addition to this Portable CO monitors to be made available at site to detect gas leakage. ❖ Person should not move without detector inside cellar. ❖ Adherence to SOP for Gas change over operation ❖ Check that all COG DP plugs are in position before opening CO gas cocks. ❖ Close BF gas cock by observing the indication mark. ❖ Use gas monitor to check concentration of CO. ❖ Don't be empty stomach. ❖ Ensure smooth operation of CO /BF gas butterfly valve. ❖ Ensure positive pressure (>50mmwc) always in gas pipe line. ❖ Interlock to be provided to bring reversing winch machine in pause in case of very low pressure to prevent air infiltration inside the pipe line to protect explosion. ❖ Fire Extinguisher to be provided. <p><i>(Refer SG-21: Safety Guideline</i></p>

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<i>for Handling Fuel Gas)</i>
		Pre heater cleaning in CO line	<ul style="list-style-type: none"> ❖ Proper and strong scaffolding with proper clamping and railing to be made. ❖ Use full body harness when working at height. ❖ Proper closing of valves to be done. ❖ Ensure that proper size plates are used for blanking. ❖ All bolts to be tightened properly after blanking. ❖ Proper ventilation to be maintained in and around area where job is going on. ❖ No cutting/ welding job is allowed. ❖ No spark to be allowed in the area. ❖ Explosion test to be done before starting of job. <p><i>(Refer SG-02: Safety Guideline for Working at Height, SG-21: Safety Guideline for Handling Fuel Gas)</i></p>
4)	Coke Sorting Plant / Coke handling Plant	Moving Conveyor	<p>Conveyor safety procedure to be followed.</p> <p><i>(Refer SG-19: Safety Guideline on Operation and Maintenance of Conveyor Belts)</i></p>
		Fire due to hot coke	Spot quenching at wharf & provision of MVWS to avoid hot coke going on conveyor.
B) COAL CHEMICAL DEPT. / BY- PRODUCT PLANT			
1)	Gas Condensation section	Spillage of hot liquor from leaky flanges / pump gland	Regular inspection to observe flange / gland leakage before change over and rectify the same with safety protocol.
		Burn due to leaky	PPEs to be used to attend

Sl. No.	Area/Section	Hazards	Risk Control Measures
		steam line flange / hot condensate / touching hot steam line	leaky flanges / glands. <i>(Refer SG-18: Personal Protective Equipment (PPE) Management)</i>
		Exposure to COG from leaky lines/ flanges/ valve gland packing etc	<ul style="list-style-type: none"> ❖ Regular inspection of COG lines to detect leakage if any. ❖ Online CO monitors with alarm system to be installed & portable CO monitors to be used to detect Gas leakage. <i>(Refer SG-21: Safety Guideline for Handling Fuel Gas)</i>
		Explosion in COG line.	<ul style="list-style-type: none"> ❖ Regular check of Oxygen % in COG and take appropriate action in case $O_2 > 0.8\%$. ❖ Hot job is prohibited. <i>(Refer SG-21: Safety Guideline for Handling Fuel Gas)</i>
		Exposure to gas leakage from flanges opened during job execution	<ul style="list-style-type: none"> ❖ Protocol Job ❖ Use of gas masks ❖ Thorough isolation of gas lines before opening flanges <i>(Refer SG-21: Safety Guideline for Handling Fuel Gas)</i>
		Fire Hazard due to spark generation while opening flanges	<ul style="list-style-type: none"> ❖ Job protocol to be made. ❖ Thorough isolation of gas lines before opening flanges. ❖ Use grease smeared tools / non sparking tools. ❖ Keep portable fire extinguisher ready on easy approach or call fire services for stand by duties if required. ❖ Take shutdown of nearby equipments, power etc. to

Sl. No.	Area/Section	Hazards	Risk Control Measures
			avoid chances of spark. ❖ Proper scaffold / platform with 2 means of exits. ❖ Adherence to SMPs. (<i>Refer SG-21: Safety Guideline for Handling Fuel Gas</i>)
		Exposure of body parts to coal tar	❖ Safety training and do's / don't instruction to workers ❖ Use of PPEs, hand gloves, gum boot etc. (<i>Refer SG-18: Personal Protective Equipment (PPE) Management</i>)
		Work in confined space / pits	❖ Permit to work to be taken from owner deptt. ❖ Safety training and do's / don't instruction to workers ❖ Check concentration of oxygen, toxic , explosive gases etc. prior & also intermittently as required ❖ Proper emergency rescue arrangements ❖ Check proper cross ventilation (<i>Refer SG-03 Safety Guideline for Working in a Confined Space</i>)
		Exposure to CO/ Mixed gas	❖ Use of gas mask if CO % is above 50ppm ❖ Maintain water seal. (<i>Refer SG-21: Safety Guideline for Handling Fuel Gas</i>)
		Injury due to sudden rotation of machine	❖ Take shutdown of Motor in proper pro-forma. ❖ Close suction & discharge valves to avoid back rotation. (<i>Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance)</i>)

Sl. No.	Area/Section	Hazards	Risk Control Measures
		Falling from height	Use of full body harness with lifeline, Adherence to Safe work procedure (Refer SG-02: Safety Guideline for Working at Height)
2)	Ammonium Sulphate Plant	Exposure to ammonium Sulphate powder	❖ Use of all required PPEs. ❖ Regular housekeeping in the section. (Refer SG-18: Safety guideline Personal Protective Equipment (PPE) Management)
		Exposure to sulphuric acid spray	❖ Regular checking of pipe lines, repair as per requirement. ❖ Maintain condition of pipe, flanges & flange guards, valve glands etc. ❖ Keep distance while acid unloading is going on.
		Exposure to acidic liquor	❖ Use face shield, PVC suit and shoes while working on acid line. ❖ Safety shower to be provided.
3)	Benzol Recovery section	Exposure to Benzol vapours	❖ Use gas mask. ❖ Check/ use of continuity jumpers over pipeline flange. (Refer SG-18: Safety Guideline for Personal Protective Equipment (PPE) Management)
4)	Benzol Rectification Plant	Exposure to BTX vapours	❖ Usage of mechanical seals in pumps. ❖ Usage of gas masks.
		Fire	❖ Fire extinguisher & hydrant ring. ❖ Continuity jumpers over pipeline flanges. ❖ Earthing of tankers while loading. ❖ Prohibition on usage of

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<p>mobile phones.</p> <ul style="list-style-type: none"> ❖ Strict adherence to SOPs & SMPs. <p><i>(Refer SG-16: Safety Guideline for Fire Safety)</i></p>
5)	Tar Distillation Plant	Formation of Explosive mixture leading to explosion	Explosive mixture is to be checked before starting of work.
		Explosion/ Fire hazard	<ul style="list-style-type: none"> ❖ Use of PTW before start of job for ensuring proper isolation. ❖ Lines to be thoroughly flushed before start of job. ❖ Fire extinguishers are kept near work place for use in case of minor fire. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance))</i></p>
		Spraying/ Spillage of tar/ tar product	<ul style="list-style-type: none"> ❖ Use of apron, face shield, gum boot etc. ❖ Isolation of line & draining of line before starting job. ❖ Regular cleaning of the area. <p><i>(Refer SG-18: Safety Guideline for Personal Protective Equipment (PPE) Management)</i></p>
		Exposure to cold wash oil	Use of apron with face shield
6)	Sulphuric Acid Plant	Exposure to acid from leaky flange, valve glands etc	<ul style="list-style-type: none"> ❖ Regular checking of pipe lines, flanges and gland for possible leakages and attend leakages on priority. ❖ Keep safe distance from acid lines while pump is in operation, ❖ Use of PVC suit, face shield & all required PPEs.
		Overflow of acid from wagon	❖ Develop & follow SOP for Acid loading / lifting.

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<ul style="list-style-type: none"> ❖ Keep a safe distance from acid wagon. ❖ Use all required PPEs Face shield, PVC suit.
		Exposure to acid from leaky / open flange, valve glands etc.	<ul style="list-style-type: none"> ❖ Ensure proper isolation and shut down before hand over of line for maintenance; ❖ Keep safe distance from open flanges. <p><i>(Refer SG-22: Safety Guideline for Energy isolation)</i></p>
		Exposure of molten sulphur to body part. Inhalation of sulphur dust, eyes exposed to sulphur dust	<p>Use of all available required PPEs like hand gloves, gum boots, Face shield, dust mask, goggles, & acid proof apron.</p> <p><i>(Refer SG-18: Safety Guideline for Personal Protective Equipment (PPE) Management)</i></p>
C) COKE DRY COOLING PLANT (CDCP)			
	CDCP & associated facilities	Explosive mixture on circulating gas route	<ul style="list-style-type: none"> ❖ Working of interlocks and automation shall be ensured. ❖ Percentage of oxygen content should not exceed 1 %. ❖ Percentage of hydrogen content should not exceed 4 %. ❖ Percentage of Carbon mono oxide should not exceed 8%. ❖ Availability of Nitrogen shall be ensured. ❖ Proper functioning of nitrogen valves shall be ensured. ❖ Proper functioning of gas bleeder valve after mill fan shall be ensured. ❖ Proper functioning of pre-chamber bleeder valve shall

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<p>be ensured.</p> <ul style="list-style-type: none"> ❖ Explosion flaps located in the circulating gas path shall be in proper cleaned condition and should be inspected time to time. ❖ Proper functioning of air breather valve at pre-chamber shall be ensured. ❖ Proper functioning of gas analyzer shall be ensured. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance) & SG-16: Safety Guideline for Fire Safety)</i></p>
		<p>Person hit by arms & hooks of Crane at Coke bucket repair garage.</p>	<ul style="list-style-type: none"> ❖ Siren gong bell and auto announcement during movement of Crane. ❖ Before starting of Crane long hooter should be given and operator to check for any person doing any job. ❖ Development & adherence to SOP. <p><i>(Refer SG-13: Safety guideline for Material handling (manual and mechanized) & storage)</i></p>
		<p>Moving Conveyor after discharging device</p>	<ul style="list-style-type: none"> ❖ Shutdown/ permit to work with electrical isolation. ❖ No work should be done on conveyor in running condition. ❖ Always operate Local emergency switch for approaching conveyor. ❖ Availability & working of Pull chord. ❖ Siren system prior to restarting conveyor. ❖ Loose cloths prohibited. ❖ Area barricading if material is removed from height.

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<ul style="list-style-type: none"> ❖ Head end and tail end guard. ❖ Crossing the conveyor only through the designated place. ❖ SOP for Conveyor to be developed & followed. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance), SG-13: Safety guideline for Material handling (manual and mechanized) & storage & SG-19: Safety guideline on Operation and Maintenance of Conveyor Belts)</i></p>
		<p>Burn & Injury due to HP/ MP/ LP steam</p>	<ul style="list-style-type: none"> ❖ Regular inspection of steam pipeline. ❖ IBR authorized / certified personnel should only be allowed for operation and maintenance of Boiler. ❖ The periodic inspection of Boiler inspector for certification & validity of license shall be ensured. ❖ Calibration of visible inspection gauge on regular basis. ❖ Proper inspection, testing and functioning of safety valves of Boiler drum & SH Steam pipeline. ❖ Operator/ technician should wear Safety jackets while working around steam pipeline. ❖ Development & adherence to SOP. ❖ PPEs to be used to attend leaky flanges / glands. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance), SG-05: Safety</i></p>

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<p><i>guideline for Illumination at workplace & SG-18: Safety guideline for Personal Protective Equipment (PPE) Management)</i></p>
		<p>Hot coke falling on person from coke bucket while lifting / moving of Coke Bucket Lifter. Free fall of hot coke bucket.</p>	<ul style="list-style-type: none"> ❖ Visual inspection of coke bucket lifter rope on regular basis. ❖ Scheduled replacement of rope as per SOP shall be ensured. ❖ Visual inspection of brake and brake shoes of coke bucket lifter on regular basis. ❖ Nobody should pass in front/ below of Coke Bucket Lifter. ❖ Proper gripping of hooks at both side arms of coke bucket shall be ensured while lifting hot coke bucket. ❖ Interlock to stop lifting of the bucket in case the hook is engaged only on side. Also it is preferred to install load cells on lifters to give feedback of load being lifted as well as individual hook load to ascertain proper load transfer on the lifter hooks. ❖ All watchman / field-man of lifter should wear FR jackets. ❖ Siren gong bell during lifting / moving of Coke Bucket Lifter. ❖ Working of interlocks and automation of coke bucket lifter shall be ensured. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance)</i></p>

Sl. No.	Area/Section	Hazards	Risk Control Measures
		Person hit by Coke Bucket Car & Electric Loco	<ul style="list-style-type: none"> ❖ Siren gong bell during movement of Coke Bucket Car & Electric Loco. ❖ Auto announcement during Coke Bucket Car & Electric Loco operation. ❖ Before starting a standing Coke Bucket Car & Electric Loco long hooter should be given and operator to check for any person doing any job. ❖ Permit to work prior to undertaking any maintenance job around Coke Car Track & Bus bar. ❖ Climbing prohibited on running machine. ❖ Interlock to be provided to stop the machine if someone tries to climb on running machine. ❖ Development & adherence to SOP. <p><i>(Refer SG-04: Safety Guideline for Permit to Work (Operation & Maintenance), & SG-25 Safety guideline for Loco Operation)</i></p>
		CO Gas accumulation & fire in Conveyor Tunnel	<ul style="list-style-type: none"> ❖ Online CO monitors with alarm system to be installed for detecting CO gas accumulation. ❖ Portable CO gas monitors to be made available at site to detect CO gas accumulation. ❖ Person should not Move without detector inside Conveyor Tunnel. ❖ Adherence to SOP for maintenance job in Conveyor Tunnel. ❖ Don't go for work with

Sl. No.	Area/Section	Hazards	Risk Control Measures
			<p>empty stomach.</p> <ul style="list-style-type: none"> ❖ Fire Extinguisher to be provided. ❖ Ensure continuous running of ventilation fan on Conveyor Tunnel. ❖ Spot quenching system to be provided to avoid hot coke onto the moving conveyor. ❖ Working of interlocks and automation of shall be ensured. ❖ Coke temperature detectors installed on conveyor belt / discharging device will give feed back to control the discharging rate to avoid hot coke discharge on Coke conveyor than the permitted value. ❖ Provide automatic fire detection cum alarm system (by LHS cable) along with automatic MVWS system. <p><i>(Refer SG-04; Safety Guideline for Permit to Work (Operation & Maintenance), & SG-16: Safety Guideline for Fire Safety)</i></p>
		<p>Work in confined space / pits</p>	<ul style="list-style-type: none"> ❖ Permit to Work to be taken from owner department. ❖ Safety training and do's/ don't instruction to workers. ❖ Check concentration of oxygen, toxic, explosive gases, etc. prior to work. ❖ Proper emergency rescue arrangements. <p><i>(Refer SG-03: Safety Guideline for Working in a Confined Space, SG-04: Safety Guideline for Permit to Work (Operation & Maintenance) & SG-05: Safety</i></p>

Sl. No.	Area/Section	Hazards	Risk Control Measures
		Falling from height (Coke Bucket Lifter maintenance jobs, crane operation, etc.	<p><i>Guideline for Illumination at workplace)</i></p> <ul style="list-style-type: none"> ❖ Safety training and do's/ don't instruction to workers. ❖ Use of full body harness with lifeline. ❖ Use of safety hooks & belt. ❖ Adherence to Safe work procedure. <p><i>(Refer SG-02: Safety Guideline for Working at Height& SG-04: Safety Guideline for Permit to Work (Operation & Maintenance)</i></p>
		Fire	<ul style="list-style-type: none"> ❖ Fire extinguisher & hydrant ring. ❖ Prohibition on usage of mobile phones. ❖ Working of interlocks and automation shall be ensured. ❖ Strict adherence to SOPs & SMPs <p><i>(Refer SG-16: Safety Guideline for Fire Safety)</i></p>
		Hand getting pressed during coupling/ decoupling of Coke Bucket Car & Electric Loco	<ul style="list-style-type: none"> ❖ Use Scotch block below wheel of Coke Bucket Car and Electric Loco. <p><i>(Refer SG-04: Safety Guideline for Permit to Work Operation & Maintenance)</i></p>
		Rotating machineries (ID Fan, Mill Fan, Pumps, Motors, etc.)	<ul style="list-style-type: none"> ❖ Coupling guards to be in place. ❖ Loose cloth to be prohibited. ❖ Motor fan cover to be in place. <p><i>(Refer SG-09: Safety Guideline in Equipment & machine Guarding)</i></p>

Note:

- 1) The operating procedure as given in the write-up may vary from shop to shop due to different equipment disposition and type. Safety precautions under each head may be separately identified.
- 2) Other standard plant safety procedures shall be followed.
- 3) Signages and emergency escape route shall be shown covering the entire shop.
- 4) Provision & Operability of safety fences should be ensured covering the entire shop.
- 5) The above safety guidelines have been prepared keeping in view standard points applicable to the area of work in the steel industry. SOPs (Standard Operating Procedures) & SMPs (Standard Maintenance Procedures) are to be developed and followed by users as per specific processes / equipment/ technologies deployed as well as prevailing site conditions, in respective plants.