Combustible Gas (CG)
Risk and Mitigation

Hazard: Fire and Deflagration, Personal Injury

Version 1 - 12/03/18

Hazard Identification	Mitigation options (Bold = Leading/Best Practice)
Normal Operations	
1. Dust/creosote collected in ductwork, fan housings, etc. creates potential for dry fibre and CG generation	**Pre start up safety review.**
	Insulated ducting. (Limit cooling/temp variation, avoid condensation and material buildup)
	Regular cleaning of ducting .
	Spark Detection with automatic deluge and abort systems installed at areas of collection.
	Manual Deluge systems installed.
	Air flow monitoring. (Differential air pressure sensors in cyclone, alarms for upset conditions)
2. Combustion gases produced in drying process	**Management of Change process for all new systems and alterations to existing systems.**
	Installation and monitoring of combustible gas sensors.
	ID Fan in continuous operation.
	Deluge dryer system if fire event occurs.
	Programmed purge cycles. (particularly at start up and shut down)
	Programmed and manual load spray.
3. Drying temps too high	**Monitor by HMI - alarms and trending.**
4. Oxygen levels too high	**Eliminate all leaks in system allowing air to enter.**
	O2 sensors to monitor levels.
5. Grounding and bonding of systems i.e. static ignition	**Follow NFPA standards for grounding and bonding.**
	Regular inspection (visual, infrared, conductivity) and maintenance.
6. Effective Operator Training	**Updated training, procedures and process hazard assessments.**
Upset Conditions	
1. Power loss resulting in shutdown of system leads to buildup of residual heat and potential for ignition of combustion gases	**Backup generator to keep system running until safe shutdown.**
	Appropriate training for monitoring and response to power loss including emergency shut down procedures. i.e. operator and supervisor training.
	Automated emergency shutdown process in place.
	Reassess backup power generation when operations or procesess are changed or equipment is added.
2. Power surge affecting system	**Systems and actions in place to confirm continued operation of critical safety components (Power bump checklist, fans, airlocks, dryer, etc.)**
	Surge protectors on HMI.
3. Inadequate evacuation of exhaust gases	**Maintain function of ESP or other emission controls.**
	Programmed purge cycles.
	Back up system in place for emissions/ may include amended emissions permits.
4. Safety System component failures i.e. fans, interlocks, generator	**Regular inspection and predictive/preventative maintenance.**
5. Sudden Change in Fibre	**O2 analysers.**
	Fibre mix monitoring.
	Moisture sensors.
	Training. (Plant and loader operators)
	Amp monitors on infeed conveyors.
	Weigh belts on infeed.
6. Weather conditions/Cold weather events	**Predict conditions, monitoring, and inspections.**
Start Up & Shutdown Processes	
1. Shutdown Heat in system ignites residual CG	**Establish cooldown procedure, automate as much as possible. Constant ventilation.**
	Routine maintenance and cleaning.
	Operator training.
2. Rapid introduction of air and ignition source at start-up may ignite residual CG	**Load spray.**
	O2 analysers.
Repairs & Maintenance	
1. Hot work ignites residual CG or condensed VOCs	**Hot work permit system, with special procedures for work in areas of potential CG collection.**
	Active monitoring of hot work.
	Limit hot work to shutdowns.
Confined Space Entry (dryer systems, storage bins, ducting systems)	**Confined space hazard assessments and permits identify potential for CG with appropriate controls.**
	Continuous gas detection monitoring (CO, H2, CH4) for both toxic and explosive levels.
	Appropriate ventilation.
	Confined space training for workers.