**WI/MAINT/22 CONFINED SPACE**

**ACTIVITY: REFRACTORY WORK IN BOILER**

**Objective** REFRACTORY WORK IN BOILER

**Responsibility** Engineer In charge

**PPEs to be used** Helmet, Safety shoes, safety hand gloves, cutting goggle, welding shields, safety belt and Dust mask

**Aspect-Impact**

Fumes Health impact

Working inside hopper Work Environment

Steel Scrap Resource Depletion

**Hazards Identified**

Mechanical: Fall of tools and material

Electrical: Electric Shock

Physical: Contact, Impact, trapping in moving part

Human error/human behavior: Non use of PPE,

Chemical : CO leakage, fumes.

SAFETY PRECAUTION

24 volt DC supply should be used for providing illumination

Cotton/Leather hand gloves, nose mask, white/black goggles should be used

Proper checking of Welding machine, gas cutting set, grinding, cut off, flexible grinding machine, etc.,

While one person is working inside, one person should always be there outside continuously to communicate and monitor to inside person.

The person working inside should wear Full Body harness (FBH) and one rope should be tied to FBH and the other end of rope should be tied outside of boiler.

Breathing apparatus should be kept with the person outside.

Special care should be taken care regarding CO poisoning. CO gas should be pre checked using CO monitor before the person entering and starting his work and check the oxygen level at working zone excess or deficient to be checked.

Also presence of any flammable gases to be checked.

Proper illumination to be ensured.

Before starting of gas cutting or welding work bottom areas must be free from fire catching media or covered or clean area.

Fumes rising from confined space where there was no manholes, keep or arrange the opening from availed spaces or else provide exhaust fan for removal of fumes

PRECHECKS

Take the work permit and check the co and oxygen level at work place.

Ensure that individual ‘U’ seal should be filled, check in every four hours by doing overflow, entire system should be in purge and CO monitors to be used.

Ensure evaporator temperature is bellow 50 degree.

Before starting of cutting set and welding machine check the testing certificate.

Before starting of welding / gas cutting work check the any leakages, clean the working areas, make a proper arrangement or put some sheet for sitting.

**Physical isolation/blanking to be provided to carry any activity inside the boiler or BFG gas line system by isolating complete BF gas sources from Pig iron Plant.**

**LTI - On 06/02/2022 at 12:00 PM 3 Anish Scaffolding workmen Mr. Manu Nag, Mr. Kunjay Naik, Mr. Lambodhar Naik, Mr. Sri ram (supervisor) who were engaged in scaffold erection as a part of boiler 1 tube replacement job became victim of gas leak. While, Mr. Manu Nag and Mr. Kunjay Naik resumed duty post observation at dispensary. Mr. Lambodhar Naik was referred to GMC Bambolim for further medical care where he was kept under observation for 24 Hrs and he joined duties next day**

***DO’S***

1. *Dust generation.*
2. *Inside heat of Boiler.*
3. *Use PPE’s.*
4. *Follow SOP.*
5. *Work permit to be issued for 8 hrs. and can be extended based on the risk identified in work permit and at site are similar.*
6. *Unauthorized operation or repair of any equipment is a punishable offence.*
7. *Before putting Entrant (helper/operator) on job attendant must ensure that Entrant (helper/operator) should familiar with the operation.*
8. *Before entering into BOILER ensure that shutdown of ID Fan is taken.*
9. *Before entering into BOILER ensure about non availability of CO presence.*
10. *Check the grizzly platform condition (made of rods) for its looseness, to avoid falling of person.*

***DONT’S***

1. *Do not by pass SOP.*
2. *Don’t enter in BOILER in presence of CO.*
3. *Don’t enter in BOILER if temp is high.*

*PRECHECKS*

1. *Before Entering in BOILER ensure –*
2. *Main Induced draft fan must be in operation shutdown with LOTO.*
3. *BOILER inside temperature should be less than 40 degree Celsius.*
4. *CO Level should be 0 ppm, MSSV valve, GD Valve, U-seal must be in operation shutdown with LOTO.*
5. *Attendant must ensure proper illumination, if illumination not found ok, he must inform concern electrical person to provide hand lamp or halogen.*
6. *Take the work permit from HOD, Safety for entering inside the confined space.*
7. *The workmen (Entrant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified entrant .*
8. *A standby (attendant) who is trained and certified by SUB head and having valid confined space gate pass should perform the activity and he can be replaced(in emergency) only by certified attendant .*
9. *Standby person who shall be positioned outside the confined space , must have no other duties other than monitoring people and conditions inside the confined space and coordinating with rescue personnel (he must have contact number of rescue team members) if required.*
10. *Standby (Attendant) person has to log down the In/Out entry of all entrants and ensure that entrant should be come out after 30 minutes from confined space for normal jobs.*
11. *In some cases In/Out time may be relaxed /extended based on the risk involved in the particular confined space.*
12. *Check Internal atmosphere of the space for sufficient oxygen content (19.5% to 23.5 %) flammable gases and vapours, and the potential for toxic air contaminants by the use of multi gas detector, if required use pump with extension before entering into BOILER. If there is any deviation, do not enter into BOILER.*
13. *Check inside temperature and it should be is in the tolerable range (25 deg C to 40 Deg C). If the temperature is not within limits then appropriate ventilation to be used.*
14. *Check for suitability of equipment that is used at the confined space.*
15. *Check any dust due to which visibility is reduced or respiratory tract is irritated.*
16. *The sign-in and sign-out of all persons entering into BOILER should be recorded.*
17. *Use 24V DC supply illumination to avoid electrocution/electric shock.*
18. *Ensure that main fan damper is in open condition for natural draft during inspection and cleaning job in BOILER.*
19. *If everything is OK, enter into BOILER and start Inspection of BOILER for pressure part, refractory, GD gate valve.*
20. *Check the grizzly platform (made of rods) for its looseness, if found any deviation correct it if not, stop the work and don’t allow any person to go inside Boiler.*
21. *If inspection Ok and everything is normal then carry out activity.*
22. *After job completion ensure that all involved crew members are come out from BOILER and close the man hole of it.*
23. *All material collected into dust hoppers then open discharge gate of respective RAV and empty out.*
24. *Normalize the system and release all equipment shutdowns and close the work permit.*
25. *Give the clearance to HOD, SS from your side that your assigned job is completed.*

*Please note that this area is considered as Confined Space so needs to maintain the checklist of the activity. All In time and out time details of entrants, levels of gases to be logged in checklist (yellow copy) or in any alternate document and to be documented.*

***Role of Rescue Team***

***As the work is being carried out inside Boiler and its Ducting, in an emergency victim can be taken out by use of rescue apparatus such as stretcher. However attendant should call ambulance which is fully equipped. However rescue team members should take a charge of the situation.***

**Procedure**

**The Engineer in-charge shall ensure the following before commencement of work**

Before start of work ensure the pre checks.

Use full body harness before entering confined space to have ease of rescue.

In case of height work, Scaffolding to be done by certified scaffolders and later to be certified by competent person. Before entry of scaffolder in confined space, ensure they are properly trained about confined space entry, associated hazards and control measures or they must have confined space pass.

Remove the debris of refractory fallen inside, so as to eliminate risk of trip and fall.

In case of damaged refractory wall portion of section, cut the same by gas cutting.

Remove the damaged the portion. Measure the size of damaged portion require repair.

Cut the plate outside the confined space to required size and grind the same.

Repair the damaged wall by welding new plate.

Remove the old damaged anchors from the walls by gas cutting and shift it outside the confined space.

Weld the new anchors on the walls from wherever removed.

Make the refractory material castable or equivalent ready outside the confined space.

Repair the damaged refractory on walls.

Do the housekeeping. After exit of all confined space entrant, close the manhole.

Normalise the isolations after completion of work.

**Corrective action and preventive action on above LTI**

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| Sl no. | Recommendations | Responsibility |
| 1 | SOP to be revised stating that whenever jobs in pressure parts (BFG line, steam line, water line, etc) are taken up positive isolation such as blanking/ provision of Goggle valve should be done | Nitin Gaikwad, Deepak Kudalkar  & Anand Ghadigaonkar |
| 2 | Steam purging system should be installed at PP | Deepak Kudalkar |
| 3 | Pressure transmitter should be installed at strategic location so as to determine the line pressure of BFG entering PP | Vengatesan |
| 4 | Explore the possibility of providing Purging vent valve provision should be provided | Deepak Kudalkar |
| 5 | U seal and drip pots inner parts may be checked at desired intervals by dismantling by preparing schedule | Nitin Gaikwad & Deepak Kudalkar |
| 6 | In gas prone areas whenever job is carried out at multiple levels at least one portable CO monitor should be present with people working on each level | Nitin Gaikwad & Deepak Kudalkar |
| 7 | Explore the possibility of changing the Boiler U seal design at PP if required | Deepak Kudalkar & Nitin Gaikwad |
| 8 | More online CO sensors should be fitted at strategic locations | Vengatesan |
| 9 | Portable self powered CO monitors to be procured that has audio/visual alarm with a wireless communication to control room, | Vengatesan |