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|  | **VEDANTA LIMITED –**  **VALUE ADDED BUSINESS** | **Format No.:** | **FRMT/MR/10** |
| **INTEGRATED MANAGEMENT SYSTEM** | **Revision Date:** | **10.07.2023** |
| **HAZARD IDENTIFICATION** | **Revision No.:** | **02** |
| **Page No.:** | **1 of 1** |

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| **Departmental Use Only** | |
| **Revision No: 07** | **Unit: PID1** |
| **Revision Date: 10.07.2023** | **Dept.: Production** |

A. Work activity information

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| **Sr.No.** | **Details** | **Remark** |
| 1) | Task being carried out, their duration and Frequency: | PCM Operation (hot metal pouring, clearing pouring spout & maintaining ladle spout, cleaning PCM tray)  30 to 45 min. 12 to 16 times per furnace per day |
| 2) | Location (s) where the work is carried out. | PCM area |
| 3) | Who normally/occasionally carried out the task? | Contractor’s laborers, company employees & supervisors. |
| 4) | Who else may be affected by the work (For example visitors, subcontractors, the public) | Visitors |
| 5) | a) Has the personnel trained for performing the task  b) Any special training required | Yes  No |
| 6) | Is the written systems of work mandatory? If yes state, the procedure no. | Yes.  VL/IMS/PID1/PROD/WI/14 |
| 7) | Is the work permit required for the task? | No |
| 8) | Plant and machinery that may be used:  Eg : crusher, conveyor, crane, heavy earthing equipment, Truck etc, | Motors, Moulds, Lime pumps, 50t crane 10 T crane & monorail crane etc. |
| 9) | Any electrically operated hand tools are used | No |
| 10) | Manufacturers or supplier’s instructions for operation and maintenance plant machinery and powered hand tools are available or not: | yes |
| 11) | Chain block, tools and shackles such as wire rope, hydraulic jack etc are used. | No |
| 12) | What materials are handled? Size, shape, surface character and weight of materials that may be handled: | Solid moulds, Ladle & liquid metal  (40 MT) |
| 13) | Is the material is required to be moved by hand. If yes Distance and heights of the place where materials have to move by hand. | Shifting of Moulds from a distance 1000 miters and height up to 02 mtrs |
| 14) | Services used Eg: compressed air, oxygen, acetylene,  LPG gas, hydraulic oil, welding electrode for welding | NIL |
| 15) | Physical form of substances encountered during the work (For example fume, gas, vapour, liquid, dust/powder, solid): | Hot metal, Ladle |
| 16) | Content and recommendations of safety data sheets relating to substances used or encountered:  (This is applicable in case of chemical material) | No |
| 17) | a) Relevant acts, regulations and standards relating to the work being done, the plant and machinery used, and the materials used or encountered:  b) Is the activity is reviewed for compliance to statutory requirement | Factory Act  Yes |
| 18) | What is the data (s) required to be monitored during the activity and the frequency of monitoring? | NIL |
| 19) | Any information available from within and outside the organization on incident, accident and ill health experience associated with the work being done, equipment and substances used: | Yes |

2. From the above activity information hazards are to be identified and recorded below using Appendix 'A' of SP/41

1. 26.08.2003, Operator found not wearing apron while the pouring was on
2. 28.04.2003, contract labour (Mr.Chandrakant) met with burn injury as the hot metal spark fell on his lip.
3. While moving near the PCM area mould fell on the lime water and the lime water was splashed on the body of a labour.
4. 25.09.2003, contract met with burn injury at his neck
5. 15.01.2004, Backhoe damaged the overhead cable tray while shifting the ladle- Araujo
6. 21.06.2004, Ladle (L-2) found warped at 03 places after completing 376 heats-James
7. 11.10.2004 Contractor labour fell down as his co-worker knocked him from behind due to metal splash during pouring.
8. 24.03.2005, PP&B wheel loader operator dumped the clay from PCM1 pouring spout side while the pouring was on.
9. On 06.04.2005, there was metal splash while cleaning the pcm-1 spout causing burn injury to the operator
10. On 10.08.2005, at 14.15 hrs. while removing the metal jam with the help of crowbar work got hit by crowbar.
11. On 17.09.2005, PCM-3 Tripped as rod got stuck between the moulds.
12. On 06.12.2005, PCM-4 hand railing damaged
13. On 14.06.2006 contractor labour operated the wheel loader and damaged PCM-1 lime tank platform
14. On 27.03.07 While placing ladle on the tilter, crane no. 01 hit, crane no. 02 which was

pouring in PCM3.Due to hitting small quantity of metal spilled out. Gani Naik

1. On 02.04.07 Contractor workmen working in PCM area crossed under the lifted W/L

bucket at the time when wheel loader operator was lowering down the bucket. Sheamani

1. On 24.05.07 during operating PCM #3 monorail crane for shifting the skull piled up near.

the deflector plate of PCM 3, off a sudden the entire 5T unit collapsed down

1. On 26.10.07 while pouring hot metal with the ladle tilter, the motor shaft broke down and tilter came down of its own. -Pandurang Phadte
2. On 01.07.2008 at 9:15 hrs, cast no 399 in BF2 was closed. Ladle no L-20 was under the first spout, full of metal. Around 9.30 hrs liquid metal started oozing out towards the furnace side from a hole at the side of the ladle, approx.1metre height from the bottom. The pouring of the previous cast metal was immediately stopped, and the punctured ladle was emptied into the other ladle, by using BF2 hot metal crane.
3. On 8.3.2010 in the night shift at 06:20 hrs ladle L -31 which was full of hot metal got punctured below the trunion area below point no 15. The ladle was repaired on 10 th Feb taken in line on 12th Feb in the night shift after refractory repair when at this time it had completed 396 heats. The maximum temperature taken of this ladle at 03:55 hrs today was 344 degC at point no 24. The ladle was lifted with BF 1 crane and poured into another empty ladle
4. On 21.04.2010 at around 12:30 hrs while preparing PCM 3 spout the PCM operator was standing on the stationary PCM and was preparing the spout. Although the isolator switch was operated in ‘OFF ‘position the ‘LOTO LOCK’ system was not implemented.
5. On 02/06/10, at 12.45 hrs, the injured was cleaning the debris at the tail end with a crowbar and his thumb hit the adjusting screw of the PCM during crowbar movement resulting in a very minor skin abrasion to his thumb. He was given first aid & resumed to work.
6. On 29.03.2015 during 3rd shift in PCM 2 area Mr Ajay Saroj of Kudneshwar Industries was cleaning loose pigs from PCM 2 Tail End. While shifting stickers of 4 pigs it slipped and fell on his big toe of his right foot. He was taken to PID dispensary for treatment and after the first aid returned to work.
7. At around 16:40 hrs Mr Subhash Gauns, Trainee multiskilled workman from production dept was trying to remove the PCM-4 deflector plate jam after pouring was over. During this jam removing pipe which was used for removing jam got slipped from the jam and he lost his balance and his left hand come in between slipped pipe and metal jam which was already removed earlier. In this his left-hand ring finger got injured. He was immediately shifted to dispensary for treatment.

Causes: Preliminary Investigation:1) Slight sloping work surface near PCM42) Skull accumulation on site

CAPA:

1)Ensuring Proper housekeeping by removal of skull from work

2) Leveling the work surface near PCM4

3) Providing tear resistant gloves to workers engaged in skull removal operation.

1. On 01.07.2019 At around 16.25 hrs Mr Manik Kisku contractor workman (Kudneshwar contractor) got minor cut to his upper lip with the lancing pipe hook while removing the pigs from below PCM 2. IP was wearing all the PPE. He was given first aid at dispensary and IP resume back to work.
2. On 03.08.2021 at around 11:45 pm one of company workmen working at PCM 3 on the job of stirrer disconnection, after completion of this job while returning, his leg got slipped on uneven surface and he got arrested on lime bag. No injury reported.

Root cause: Platform is not regularly cleaned which results in accumulation of lime slurry.

CAPA: Corrective Actions

1) Lime bags were stacked in order

2) Slurry on the platform was cleaned

Preventive Actions:

1) Regular cleaning of lime platform to be done to avoid accumulation of slurry

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1. On 16.04.2022 at PID1 in Hot Metal Handling area (PCM) at around 08:45 hrs, after closing 1st cast of BF2,2nd spout ladle L33 was lifted for pouring after some time ladle developed a small hole below top ring due to which little spillage of hot metal occurred on floor, immediately pouring stop, ladle made empty and taken out, no damage to property, no injury to anyone.

Root cause: Difficulty in assessing / inspection after ladle cleaning due to red hot condition Hitting of the Hitachi to the bottom jam ladle which caused ladle refractory dislodging of top rings.

CAPA: 1. Pouring done immediately by lifting ladle, ladle made empty and taken out from circulation for relining

2.L33 ladle complete relining to be done after taking to ladle refractory shop

3.Judicious hitting with Hitachi breaker during ladle cleaning activity giving due attention to ladle wall refractory bricks. Necessary repair is to be taken up if required before taking in circulation.

4.Though Ladle shell temp is being monitored after completion of 350 heats below ladle trunnion the same needs to be monitored above trunnion for temperature uniformity on shell.

5.Feasibility of ladle thermography after completing 350 heats for better monitoring.

1. On 10.09.2022 at PID1 in Hot Metal Handling area (PCM) around 13:45 hrs, after 5 min of diverting metal of BF1, 1st spout ladle L06 developed a small pin hole below top ring towards furnace side. Due to which minor spillage of hot metal occurred on the floor. Immediately ladle removed from the spout & pouring started. Ladle made empty and taken out from the circulation. No injury to anyone.

Root Cause: No assessment/ inspection of ladle refractory after ladle cleaning.

CAPA: 1. Ladle taken out of circulation after pouring metal.

2. Checklist to be incorporated with Responsibility after every Cleaning of ladle.

3. Explore feasibility of AI based ladle refractory health monitoring on real time basis.

4. SOP and HIRA to be reviewed.

1. On 30.09.2022 at PID1 in BF1, third cast suddenly blown hard at 19:55Hrs. Immediately wind reduced, and cast closed. Simultaneously at PCM2 L1 pouring was going on with HMC1. The metal spark during hard blow went on HMC1 and minor fire caught below 10T motor gear box damaging limit switch cable. Immediately pouring stopped and fire extinguished with a fire extinguisher. No injury to anyone.

Root Cause: Cast blow off leading to spatters from taphole which fell on Hot metal crane

Contributory Cause: Oil leakage from gearbox was easy combustible material available to catch fire

CAPA: 1. Pouring at PCM 2 was stopped and cast was immediately closed, and fire extinguished with fire extinguisher.

2. Regular cleaning of the crane on planned shutdown days – Operation

1. On 30/09/22 at around 4:45hrs after completing night shift third cast L1 pouring, empty ladle was moved side of PCM 2 by 50T cross travel to place the ladle for second spout for opening fourth cast, while 50T hook was cross travelled to move the ladle side, 50T hook towards river side got bend with 10T hook engaged and empty ladle came on ground level. Alcohol test was negative for both the pourers. No injuries occurred.

Root Cause: Over hoisting of 10T hook due to which ladle got lifted and pins came out from 50T hooks

Contributory cause:

Other side ladle pin is not visible to the operator

CAPA: Restricting hoisting to certain degree only (OEM recommendation).

2. SOP and HIRA to be reviewed

**Hazards identified**

1. Contact with hot metal
2. Fire & Explosion
3. Contact with hot metal due to ladle warp
4. Hot metal Ladle falling
5. Mech Impact Backhoe damage the overhead cable tray
6. Contact with steam
7. Entanglement/trapping
8. Fall of Pig
9. Contact with metal spark while cleaning the spout while pouring was on
10. Contact with metal spark, while dumping PCM consumable
11. Impact by PCM tools
12. Fall of a person
13. Impact of wheel loader to the PCM platform
14. Contact with hot ladle shell
15. Eye Contact with lime powder
16. Impact or run over moving machinery
17. Impact due to both hot metal crane collision.
18. Unwanted movement of equipments like tilter, hot metal crane etc.
19. Human Behavior -Nonuse of PPE & WI
20. Human Behavior -Improper house keeping
21. Inadequate local lighting
22. Throwing PCM dam jam without looking person all around
23. Puncture of ladle when it is full of hot metal.
24. Impact with moving machinery
25. Heat
26. Vision impairment due to glare of metal
27. Dust inhalation
28. Burning due to contact of metal
29. Sing cold powda during the scooping of dam
30. Improper Securing Chain.
31. Dis engagement of DS ladle transfer car wire rope before wheel loader moves in the area.
32. Non-working of limit switches of ladle transfer cars
33. Slip of person on walkways.
34. Contact with hot water
35. Contact with flying metal chips at PCM discharge end
36. .
37. Ladle puncture
38. Misjudging while lifting the pig.
39. Overloading of Crane
40. Overloading of pig carrying truck
41. Metal eruption during SSG
42. Fall of ladle

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| **Prepared By:** | **Reviewed By:** |
| **Signature:** | **Signature:** |
| **Review Date: 10.07.2023** | **Review Date: 10.07.2023** |