

**Project Title:** Study on blast optimization at Sukinda Chromite Mine vis-a vis monitoring of blast induced vibration and qualitative assessment of explosive and its accessories

**Project No.:** SSP/389/2019-20

**Executive Summary:** This report relates to the study conducted by CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad to optimise the blast design parameters at Sukinda Chromite Mine of M/s Tata Steel Limited to achieve optimum fragmentation and to control vibration, air over-pressure/noise and fly rocks within safe limits for the safety of buildings and other structures in close proximity to the mine. The study involved experimental trials with varying blast designs and charging patterns, monitoring of ground vibration & air over-pressure/noise in the concerned locations/villages. The results of investigation, analyses of data are summarised below:

- ❖ Altogether, fourteen (14) blasts were conducted at different benches of Sukinda Chromite Mine, Tata Steel Ltd. The maximum vibration recorded was 12.13 mm/s with dominant peak frequency of 3.875 Hz recorded at 419 m towards tailing pond from the blasting site (Mid Band Ore Box-cut). For the same blast instrument placed at Pit office (at 546 m ) has recorded the vibration level of 2.965 mm/s with dominant frequency of 3.75 Hz.
- ❖ The maximum air over-pressures recorded was 131.4 dB (L) at 290 m on pit road towards the radar installation point due to the blast conducted at Northern Band OB 10 Departmental area face on 01.11.2018. There was no ejection of fly rocks in any of the blast.
- ❖ All the recorded data (blast vibrations, air overpressures and fly rocks) were well within the safe limits at the houses/structures concerned in the periphery of the mine. The dominant peak frequencies of ground vibrations confirmed that concentration of frequencies is in band of were in the range of 2.375 to 10.75 Hz. So, the safe level of vibration has been taken as 5 mm/s for the safety of houses/structures not belonging to owner and 10 mm/s for the houses/structures belonging to owner as per DGMS standard.
- ❖ The recorded in-the-hole VODs of the SME explosives of M/s IDL Explosives Limited were in the range of 4600 – 4740 m/s. The surface VOD of emulsion boosters (125 gm) of M/s IDL Explosives Limited was detected 5283 m/s. Uniform VOD is mainly required throughout the blast holes in harder formations to produce sufficient detonation pressure to the borehole walls and is essentially required to achieve desired fragmentation. The cup density of SME explosives at the time of charging was 1.28 gm/cm<sup>3</sup> and after gassing of 20 minutes it was in between 0.9 gm/cm<sup>3</sup> and 1.00 gm/cm<sup>3</sup>. The overall fragmentations resulted from all the blasts were excellent and optimum for loading.
- ❖ The scattering issue should be addressed to the suppliers/manufacturers. Scattering tests of delay detonators revealed that the sequence of detonation is

	<p>not in order for few delays and scattering was observed in the entire NONEL delay detonator, which requires attention.</p> <ul style="list-style-type: none"><li data-bbox="656 317 1390 558">❖ The blast designs followed during the blasting were found to be safe. The analyses of data with linear superposition technique confirmed that the delay interval between the rows should be 25-30 ms/m of effective burden. The recommended blast designs (Figures A1) should be followed in day-to-day blasting operations for safe and efficient blasting operations with judicious modifications.</li></ul>
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