

Whole body vibration exposure of heavy earth moving machinery operators in Indian mines

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Abstract

Heavy earth-moving machineries (HEMM) are used in opencast mines for loading and transportation of ore and overburden as well as excavation, road grading and moving muck-piles. The operators of these equipments are exposed to whole body vibration (WBV) over a lifetime for 6-8 hours per day. The conventional foam-spring type seats provided in these equipments usually resonate at 4 Hz which is close to the resonance frequency of lumbar region of spine in the human body. Low back pain and spinal degeneration are strongly associated with this type of exposure. Frequency weighted root mean square (R.M.S.) acceleration of 18 (eighteen) HEMMs comprising Dumper, Dozer and Shovels were measured in three opencast mines using human vibration monitor. Analysis of data showed that 13 of 18 equipments had vibration levels beyond safe limits for four hours operation in a day as per ISO 2631-1:1997 standard. The tested dumpers and dozers indicated potential for health risk from WBV. The vibration levels of shovels were within safe limits.

Keywords: Whole body vibration, occupational health, ISO 2631-1:1997, opencast mining.

Introduction

Vibration transmitted to the body through the supporting surfaces such as feet, buttocks or back is known as Whole body vibration (WBV). There are various sources of WBV in mining industry such as 1) seat transmitted vibration from dumper, dozer, shovel, backhoes, Load-haul-dump vehicles (LHD) and road graders 2) WBV transmitted through feet while operating certain types of loaders (e.g. EIMCO 824), or during movement on the supporting structures of vibrating machines like crushers and vibrating screens. The parts of the body most likely to be injured during exposure to whole-body vibration depend on the magnitude of vibration, distribution of the motion within the body, body postures, and the frequency of vibration, direction and duration.

There is strong epidemiological evidence that occupational exposure to WBV is associated with an increased risk of low back pain (LBP), sciatic pain, and degenerative changes in the spinal system, including lumbar inter-vertebral disc disorders^[1]. Exposure to WBV has also been directly related to sick leave, disability, lost work days and chronic pain^[2].

In 1977 the International Labour Office (ILO) listed vibration as an occupational hazard^[3] and recommended: "measures have to be taken to protect employees from vibration, the responsible authorities have to establish criteria to determine the danger; when necessary, the exposure limits must be defined by means of these criteria. Supervision of employees exposed to occupational hazard as a result of vibration at their places of work must also include a medical examination before the beginning of this particular job, as well as regular check-ups later on".

The Directorate General of Mines Safety (DGMS) in India recommends adoption of appropriate steps which would ensure desirable degree of comfort and protection required against hand arm and whole body vibration. However, no specific vibration limits are indicated^[4]. Indian mining legislation is not specific enough to develop a definite strategy for evaluation and control of occupational vibration^[5, 6].

Records of two mechanized mines of India were examined to find the percentage of mining population regularly exposed to occupational vibration. According to this examination, an average of 18 % employees was found to be exposed to vibration at work^[5].

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