

# WHOLE-BODY VIBRATION KNOWLEDGE GAPS IN THE US

Helmut W. Paschold, Ph.D., P.E., C.I.H., C.S.P.  
School of Public Health Sciences and Professions, Ohio University, Athens, Ohio

## Introduction

WBV knowledge gaps include assessment of total workers exposed, US specific standards, OSHA standards, comprehensive listing of WBV magnitudes, and safety and health practitioner expertise. The knowledge gaps were identified by an extensive literature review and a prior knowledge survey by the author.

## Results

Three major studies address US occupational exposure to WBV. The ACGIH<sup>®</sup> reported about 7 million US workers.<sup>1</sup> The Occupational Environment: Its Evaluation, Control, and Environment, reported 6.8 million workers.<sup>2</sup> Both of these figures are directly based on a 1974 study providing one of the first estimates of the extent of US WBV exposure, but with significant limitations.<sup>3</sup> Walk-through inspections were conducted in 45 plants during 1971 and 1972 with observational data, not physical WBV measurements, obtained and used to arrive at a conservative total estimate of 7 million.

The National Occupational Exposure Survey (NOES) of 1981 to 1983 included WBV, Agent Code P0651.<sup>4</sup> Researchers in this study visited 4,490 establishments representing 522 industry types with 1,800,000 workers for observations of a great variety of occupational health exposures. Based on WBV observations extrapolated to employment data, NOES reported 1,082,217 US workers as potentially exposed to WBV.

A recent US construction trade survey estimated 540,000 operating engineers (operators of dozers, excavators, loaders, cranes, etc.) had occupational WBV exposure.<sup>5</sup> This high number of WBV-exposed workers in part of one industrial sector of the US workforce suggests that the NOES results greatly underestimated US WBV exposures.

Within the US, the three voluntary WBV standards most commonly referenced are ANSI, ACGIH<sup>®</sup>, and ISO. The first of the ISO WBV standards was released in 1972 and has been updated several times.<sup>1</sup> The American National Standards Institute (ANSI) originally published American National Standard S3.18 in 1979 that was almost identical to the ISO2631 and later released ANSI S3.18-2002 ISO 2631-1-1997, an adaptation of the most recent ISO standard.<sup>6</sup> WBV exposure limits published by the ACGIH<sup>®</sup> are based upon the ISO standard.<sup>7</sup> Neither NIOSH nor OSHA has issued WBV standards.<sup>1,8</sup>

WBV magnitude data has been published in a comprehensive listing for various types of equipment such as in a 2000 Great Britain WBV prevalence study.<sup>9</sup> This article reported a number of typical  $a_{wz}$  values for numerous machines or vehicles, all based on European findings. Most published WBV  $a_{wz}$  values are non-US, only a limited number of US values had been found for mining, agriculture, and railways.

A 2007 survey revealed 38.6% of the US safety and health professionals had *never* heard of WBV.<sup>10</sup> Over two-thirds (69.5%) self-rated their WBV knowledge as little or none.

## Discussion

The Wassermann et al. study, with its limitations, may still be the most accurate assessment to date. However, it was emphasized that no measurements were made during the plant tours owing to the lack of techniques to quantify WBV, and that they did not “know the relationship between the different parameters of vibration and the possible health and/or safety effect in long-term occupational vibration exposure”.<sup>3, p.39</sup> An updated assessment of exposure in the US workplace is needed.

The absence of a US data driven voluntary standard presents an obstacle to the widespread implementation of WBV remediation through governmental (OSHA) compliance activities. It can be argued that the differences between the US and European trades considering equipment and work methods may be significant with regard to WBV exposures. More monitoring and publication of WBV magnitudes is needed in the many of the US work sectors.

The safety and health community surveyed is comprised of the professionals charged with anticipation, recognition, monitoring and control of workplace health hazards. Despite the apparent prevalence and adverse health effects of WBV, the US safety and health professional community is poorly informed about this topic. Without a reasonable capacity to anticipate the hazards of WBV, the subsequent stages of evaluation and control of the hazard cannot occur, allowing the WBV hazard to continue unabated in many workplaces. Greater efforts are needed in the Research-to-Practice (R2P) aspects of WBV in the US.

## References

1. American Conference of Governmental Industrial Hygienists (ACGIH®). (2001). Documentation of the Threshold Limit Values for Physical Agents. Cincinnati, Ohio: Author.
2. Bruce R, Bommer A, Moritz C (2003). Noise, vibration and ultrasound. In DiNardi (Ed.), *The Occupational Environment: Its Evaluation, Control, and Management* (pp. 435-493) Fairfax, VA: AIHA Press.
3. Wasserman, D. E., Badger, D. W., Doyle, T. E., and Margolies, L. (1974). Industrial vibration: An overview. *American Society of Safety Engineering Journal*, 19, 38-43.
4. National Institute of Occupational Safety and Health. (1992). National Occupational Exposure Survey. Retrieved 10/20/08 from <http://www.cdc.gov/noes/default.html>
5. Kittusamy, N. & Buchholz, B. (2004). Whole-body vibration and postural stress among operators of construction equipment: A literature review. *J. of Safety Research*, 35, 255-26.
6. Griffin, M. (1990). *Handbook of Human Vibration*. London: Elsevier Academic Press.
7. Mansfield, N. (2005). *Human Responses to Vibration*. Boca Raton FL: CRC Press LLC.
8. Occupational Safety and Health Administration (OSHA). Searched February 15, 2010 at [www.osha.gov](http://www.osha.gov).
9. Palmer, K., Griffin, M., Bendall, H., Pannett, B., and Coggon, D. (2000a). Prevalence and pattern of occupational exposure to whole body vibration in Great Britain: findings from a national survey. *Occupational Environmental Medicine* 57, 229-236
10. Paschold, H.W. and Sergeev, A.V. (2009). Whole-body vibration knowledge survey of US occupational safety and health professionals, *J. of Safety Research* 40(3) 171-176.