

Daily Exposure to Hand-Arm Vibration of Technicians in Wastewater Treatment Plants and After-Sales Service [†]

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[†] Presented at the 15th International Conference on Hand-Arm Vibration, Nancy, France, 6–9 June 2023.

Abstract: This study encompasses two implementations of evaluation of the daily exposure to hand-arm vibration of employees. The first one focuses on maintenance technicians and operating agents in wastewater treatment plants and as network technicians on the water distribution network. The second one focuses on technicians in the after-sales service of a company supplying a wide range of percussive and vibrating portable tools for professionals and the general public. In both cases, we established a precise inventory of the tools used by the employees, and computed the duration of use per day of each tool. We used the INRS tools N43 “Calculette Vibrations Mains Bras” and N59 “OSEV—Vibrations transmises aux membres supérieurs” to determine the daily exposure A(8). These results were explained to the employees, with practical advice for prevention, collectively during meetings and individually during sensitization workshops.

Keywords: daily exposure assessment; hand-arm vibration; maintenance technician; wastewater treatment plant; vibrating hand tools; percussive hand tools; sensitization workshop



Citation: Petitfour, R.; Ducrot, G.; Devilleneuve, I.J. Daily Exposure to Hand-Arm Vibration of Technicians in Wastewater Treatment Plants and After-Sales Service. *Proceedings* **2023**, *86*, 38. <https://doi.org/10.3390/proceedings2023086038>

Academic Editors: Christophe Noël and Jacques Chatillon

Published: 21 April 2023



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1. Introduction

We present the first implementation of the assessment of hand-arm vibration exposure of maintenance and operations technicians working in wastewater treatment plants and network technicians working in the water distribution network; all of these workers use daily percussive and vibrating portable tools. The results of the evaluation of their daily exposure were delivered during a sensitization workshop.



We then present a second implementation that concerns the exposure to hand-arm vibration of technicians in the after-sales service of a company supplying a wide range of portable percussive and vibrating tools for professionals and the general public, who diagnose, repair, test and return the equipment received from customers. The results were presented at a meeting with the quality department, the employees concerned and members of the Economic and Social Council (CSE).

2. Method

In both implementations, we establish a precise inventory of the tools used by the employees, completed with the duration of use per day of each tool by questioning the employees and the team leaders.

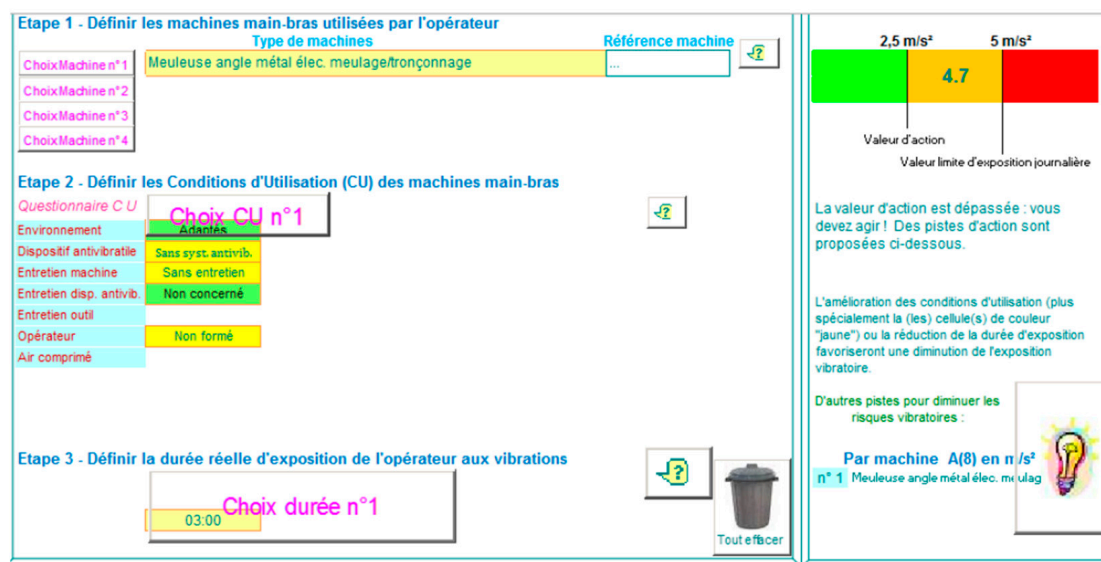
We use a “Hand Arm Vibration Calculator” [1] to compute the duration of exposure to reach the action value (2.5 m/s^2) and the duration of exposure to reach the limit value (5 m/s^2), using the vibration coefficient (or vibration level) given by the supplier in its technical data sheet and the estimated duration of exposure per day. We elaborated a table to deliver all the results; an extraction is shown in Table 1.

Table 1. Results for a vibrative tool and a percussive tool extracted from the table.

| | Designation of Portable Tool | Vibration Level (m/s ²) | Duration of One Test of the Portable Tool (sec) | Activity Area | Percussive or Vibrating Tool | Hand-Arm Daily Vibration Exposure A(8) m/s ² (for 1 h of Exposure) | Duration of Vibration Exposure Pour Action Value (2.5 m/s ²) | Duration of Vibration Exposure Pour Action Value (5 m/s ²) | Number of Tests for Limit Value (5 m/s ²) |
|---|------------------------------|-------------------------------------|---|-----------------------|------------------------------|---|--|--|---|
|  | Circular saw | 1.5 | 20 | Metal ou wood cutting | Vibrative | 0.5 | >8 h | >8 h | >100 |
|  | Rotary hammer | 12.5 | 120 | Construction works | Percussive | 4.4 | 0 h 19 | 1 h 17 | 39 |

We computed the daily exposure A(8) from the information provided by the employees utilizing the devices, including their estimated duration of exposure per day, using a simplified tool for evaluation of exposure of vibration transmitted to the upper limbs [2].

The results of the hand-arm OSEV tool were placed in a report intended for the quality manager of the company. As an example, Figure 1 displays the results for the angle grinder tool.



The screenshot displays the OSEV tool interface with the following sections:

- Etape 1 - Définir les machines main-bras utilisées par l'opérateur**:
 - Type de machines: Meuleuse angle métal élec. meulage/tronçonnage
 - ChoixMachine n°1 to n°4: (Empty selection boxes)
- Etape 2 - Définir les Conditions d'Utilisation (CU) des machines main-bras**:
 - Questionnaire C U: Choix CU n°1
 - Environnement: Adaptés
 - Dispositif antivibratile: Sans syst. antivib.
 - Entretien machine: Sans entretien
 - Entretien disp. antivib.: Non concerné
 - Entretien outill: (Empty selection box)
 - Opérateur: Non formé
 - Air comprimé: (Empty selection box)
- Etape 3 - Définir la durée réelle d'exposition de l'opérateur aux vibrations**:
 - Choix durée n°1: 03:00
 - Tout effacer: (Button)
- Results and Alerts**:
 - Bar chart showing exposure level 4.7 between action value (2.5 m/s²) and limit value (5 m/s²).
 - Alert: "La valeur d'action est dépassée : vous devez agir ! Des pistes d'action sont proposées ci-dessous."
 - Recommendations: "L'amélioration des conditions d'utilisation (plus spécialement la (les) cellule(s) de couleur 'jaune') ou la réduction de la durée d'exposition favoriseront une diminution de l'exposition vibratoire." and "D'autres pistes pour diminuer les risques vibratoires :".
 - Summary: "Par machine A(8) en m/s² n° 1 Meuleuse angle métal élec. meulag"

Figure 1. Result of the hand-arm OSEV tool for an angle grinder tool (meuleuse d'angle).

3. Results

For technicians working in wastewater treatment plants and network technicians working in the water distribution network, we assessed the eight most used tools with the OSEV tool. For seven of them, the daily exposure A(8) was between the action value (2.5 m/s²) and limit value (5 m/s²).

For technicians in the after-sales service of a company supplying a wide range of portable percussive and vibrating tools, we inventoried 262 portable tools in the table and filled it with the results of the "Hand Arm Vibration Calculator" for each of these tools. For 200 out of 262 (76.3%), the daily exposure A(8) was below the action value (2.5 m/s²). For 46 of them (17.6%), the daily exposure A(8) was between the action value (2.5 m/s²) and limit value (5 m/s²). For 16 of them (6.1%), the daily exposure A(8) was above the limit value (5 m/s²).

We could highlight the tools with exceedances of action values and limit values and give prevention advice to users to lower their exposure level, collectively during meetings and individually during an awareness workshop. Recommendations were based on flyer

“Syndrome des vibrations La main et le bras en danger” [3] (10/2016) and document “Bien choisir son outil portatif pour mieux travailler” [4] (03/2017).

Author Contributions: All authors contributed equally. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest.

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