



Maximizing Performance in Demanding Environments

Evaluating Audio Safety in Your Distribution Center

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A Vocollect White Paper

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Executive Summary

This paper is designed to help you, as an employer, ascertain the potential impact of noise from Voice-Directed Distribution to which team members are exposed in the workplace. Regulators have established upper limits for safe sound levels exposure over an eight-hour period as follows:

- Occupational Safety and Health Administration (OSHA): 90 dBA
- European Union (EU) and United States National Institute of Occupational Safety and Health (NIOSH): 85 dBA¹

Based on a representative voice-directed selection application with a duty cycle (use) of 9.7%, over an eight-hour shift with breaks and lunch, the average of all tested Vocollect-manufactured SR-20 headsets' exposure falls below these guidelines. If your application calls for a higher duty cycle, and depending on other noise in your work environment, you might choose to adjust your Talkman wearable computer audio parameters as summarized later in this document.

As part of your comprehensive audio safety program, you'll want to be certain that you can adjust audio parameters or working styles to provide a safe audio experience for team members. Talkman wearable computer parameters can be adjusted; however, if you feel your team members could be exposed to noise levels at or above the exposure action values and/or limit values applicable, we recommend that you work with qualified audio occupational safety specialists to evaluate the total noise exposure in your work environment and whether any steps need to be taken to address this.

It should be noted that, under the EU regulations, an employer is required to take action to assess and manage the risks posed by exposure to noise at exposure levels of 80dBA and above.

Why Care About Noise?

Forklift traffic, ventilation fans, compressors, machinery, and other sources contribute to collective industrial noise in your workplace to which your team members are exposed daily. Loud noise can be harmful to human hearing and may cause permanent damage.

People whose work requires them to be exposed to loud sound are susceptible to noise-induced hearing loss (NIHL) and acoustic trauma. By definition, occupational NIHL is hearing loss that develops slowly over a long period of time (several years) as the result of exposure to continuous or intermittent loud noise. Occupational acoustic trauma, on the other hand, is a sudden change in hearing as a result of a single exposure to a sudden burst of sound, such as an explosive blast².

Regulatory Agencies

OSHA

In the United States, OSHA Standard 1910.95, titled Occupational Noise Exposure, states the rules and regulations for noise exposure in the workplace. The standard provides guidelines for allowable noise exposure level and duration in the workplace. OSHA regulates how much noise or sound a worker can be exposed to and the actions that employers must take when certain limits are exceeded. OSHA set the Permissible Exposure Limit (PEL) of 90 dBA time-weighted averaged (TWA) for 8 hours. OSHA has what is called the exchange rate where an increase of 5 dBA in the sound level results in the decrease of the exposure time by half.³

¹ Directive 2003/10/EC of the European Parliament and of the Council dated 6-Feb-2003 specified 15-Feb-2006 as the date to be compliant with these directives in the EU.

² American College of Occupational and Environmental Medicine (ACOEM). Evidence-based Statement, October 27, 2002.

³ See www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=9735&p_table=STANDARDS for comprehensive explanations of the regulation.

NIOSH

Another standard for occupational noise exposure is set by NIOSH. It is not an OSHA regulation, but may be referenced by OSHA for informational purposes. The NIOSH standard is different from OSHA's in terms of the permissible exposure level and duration. NIOSH recommends an exposure limit of 85 dBA for 8 hours with an exchange rate of 3 dBA. Therefore, every 3 dBA increase in sound level cuts the exposure time by half. In this way, NIOSH's recommendation of noise exposure is more stringent than that of OSHA.

European Union

The more stringent NIOSH recommendation is aligned with the EU recommendation for noise exposure.

The Regulations

To protect workers from occupational hearing loss, government standards, federal registers (rules, proposed rules, and notices), directives (instructions for compliance officers), other federal agency standards and standards related to noise and hearing conservation⁴ have been established.⁵

These organizations have established limits for safe sound level exposure over an eight-hour period:

- Occupational Safety and Health Administration (OSHA): 90 dBA
- European Union (EU) and United States National Institute of Occupational Safety and Health (NIOSH): 85 dBA⁶

However, the levels at which employers are required to be assessing the risks presented by exposure to noise are lower, and employers should ensure they are familiar with their obligations with respect to assessing and managing noise in the workplace.

Evaluating Your Voice System

Average Results With Talkman Defaults

As you evaluate your overall audio safety program, you'll likely want to know how a Vocollect Talkman wearable computer plus an SR20 headset contributes to a team member's total Permissible Exposure Limit (PEL) for an eight-hour shift. As mentioned previously, OSHA specifies a worker can be exposed to noise for eight hours at a level of 90 dBA or below. The EU and NIOSH Recommended Exposure Limit (REL) is 85 dBA or below over an eight-hour period.

Based on a typical selection application with a duty cycle (use) of 9.7%, the average of all tested Vocollect-manufactured SR-20 headsets exposure falls below these exposure guidelines. To quantify user noise exposure levels, acoustic testing provided these results:

Talkman + SR20 Headset	Volume Setting Selected	Parameter Settings	Meets 90dBA Leq ⁷ Limit	Meets 85dBA Action Level
T5	Maximum	All default parameters	Yes	Yes
T2x	Maximum	All default parameters	Yes	Yes
T2	One less than maximum	All default parameters	Yes	Yes
	Maximum	All default parameters except "T2_Audio_Max_Volume_Att" set to "10.0"	Yes	Yes

⁴ OSHA Noise and Hearing Conservation Standards.

⁵ For the US, a list of standards, Federal registers, and directives can be found at: www.osha.gov/SLTC/noisehearingconservation/standards. For the EU, see <http://europa.eu.int>.

⁶ Directive 2003/10/EC of the European Parliament and of the Council dated 6-Feb-2003 specified 15-Feb-2006 as the date to be compliant with these directives in the EU.

⁷ Equivalent continuous sound level (Leq) was measured for a speech signal for typical picking application. It should be noted that normal and effective use of sound is not measured in an absolute dB limit, but in the time-weighted average, or Leq.

Equivalent continuous sound level was measured for speech signal. It should be noted that normal and effective use of sound is not measured in an absolute dB limit, but in the time-weighted average. It is possible, permissible, and perhaps necessary, for a particular sound level to be greater than the specified limits at various points in time because of the effect of averaging.

The measurement results were then correlated with permissible exposure level of noise set by OSHA and NIOSH. The NIOSH standards match those utilized in the EU. Directive 2003/10/EC of the European Parliament and of the Council dated 6-Feb-2003 specified 15-Feb-2006 as the date to be compliant with these directives in the EU.

Employers must also consider the impact of other environmental background noise as well as variations in their use of the Talkman to assess the actual level of noise exposure for their particular environment.

These test results were conducted with the SR-20 headset, which is used in environments with lower background noise. In applications with higher background noise, you can use Vocollect's SR-30 headset, which has an ear cup that covers the ear, enabling good audio reception at lower volume levels.

Impact of Voice on Total Noise Exposure

Speech use in the workplace with Talkman systems is a highly variable activity which can be changed by:

- Quantity of instructions required to perform a task
- Number of confirmations or verifications required
- Requests for additional information
- Language used in the instructions
- Amount of work completed during the day
- Worker customization (pitch, volume, speed)
- Worker efficiency

Depending on the total audio experience of the environment, including ambient background noise, some Talkman parameters may or may not meet worker needs. Background noise also needs to be taken into account when considering all dimensions of audio safety for a worker.

Noise in Your Environment

What will the impact of your voice system be on total noise exposure? Full evaluation of your work environment is necessary to:

- Determine the specific vocabulary used by tasks
- Determine the time the Talkman actually speaks as well as intervening time
- Calculate the "duty cycle" or percent Talkman speaks daily
- Measure the actual sound output of the task using a representative sample of headsets and calculate the average

If you feel that your team members could be exposed to levels higher than the exposure or limit action values outlined in this paper, we recommend working with **qualified audio occupational safety specialists** to assess the noise levels and advise you on the steps that you should be taking to protect your employees.

In environments where the EU Directive and implementing legislation are relevant, your obligations to take action to assess and manage the risks are triggered at an exposure value of 80dBA and an employer’s obligations would include a program which:

- Assesses the risks to your employees from noise at work
- Estimates the likely exposure to noise
- Documents the risks and reviews them with employees
- Identifies and takes action to reduce or eliminate the noise exposure that produces those risks
- Assesses the extent to which this remediation is effective
- Provides employees with hearing protection if the noise exposure cannot be reduced sufficiently by other methods
- Ensures the legal limits on noise exposure are not exceeded
- Provides employees with information, instruction and training
- Properly maintains machinery and equipment
- Carries out health surveillance where there is a risk to health

As part of your comprehensive audio safety program, you’ll want to ensure that you can adjust audio parameters or working styles to provide a safe audio experience for team members.

Changing Talkman Defaults

Because of the extreme variability of the user environment and the importance of delivering both a useful and safe acoustic experience, your voice system can be customized with parameters that set minimums and maximums for output volume.

Should your sites require customization to meet specific worker or regulatory needs, you can also adjust your voice system as shown below. These parameters may be customized for a specific sequence of work that is performed (task) by all users (operators) or for a specific user (operator).

Talkman Audio Parameters						
Platform	Parameter	Use	Parameter		Approximate average noise level in dB at 100% duty cycle	Set at
			Default	Range		
Talkman T2x and Talkman T5	Audio_Output_DB_Shift	Sets the maximum volume level for the <i>Talkman</i> ® T2x or T5. The lower the value of this parameter, the softer the volume will be on the <i>Talkman</i> ® T2x or T5.	0	-10 to 9	83dB	-10
					85dB*	-8
					87dB*	-6
Talkman T2	T2_Audio_Max_Volume_Att	Sets the maximum volume attenuation level for the <i>Talkman</i> ® T2. The smaller the value of this parameter, the louder the terminal will be.	6	0 to 59	80dB*	22
					85dB*	17
					87dB*	15
	T2_Audio_Min_Volume_Att	Sets the minimum volume attenuation level for the <i>Talkman</i> ® T2. The larger the value of this parameter, the quieter the terminal will be. Note: if set less than or equal to corresponding maximum parameter, both parameters will automatically be set to their default values.	39	0 to 59	Do not change	

* - Exposure action values are taken from Directive (2003/10/EC) of the European Union

Before you modify Talkman parameters from their default conditions, make sure you know what effect your change will have on total noise exposure. Qualified audio occupational safety specialists should be consulted for this purpose.

Document Notice:

Original Release Date: June 2006. Vocollect cannot guarantee compliance with regulations if equipment is modified or not used in accordance with recommended operational procedures. Vocollect assumes no responsibility for equipment which has been physically altered or where default settings have been changed. This document relates to the noise exposure generated by Talkman and its compliance with appropriate regulations. However, employers must consider the total noise exposure for their employees and ensure that they comply with all noise or other regulations applicable to their workplace. Information contained in this document was correct at the time of printing but does not constitute legal, technical or other advice. All warranties and representations are excluded to the fullest extent permitted by applicable law. This paper supersedes all Vocollect publications on audio safety dated prior to June 1, 2006.

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Vocollect by Honeywell Headquarters

703 Rodi Road
Pittsburgh, PA 15235
United States

+1.412.829.8145
info@vocollect.com

Vocollect EMEA

Gemini House
Mercury Park
Wycombe Lane, Wooburn Green
Buckinghamshire, HP10 0HH
United Kingdom

+44 (0) 1628 55 2900
voc_emea@vocollect.com

Vocollect Asia-Pacific

Unit 3, 29/F, Sino Plaza
255-257 Gloucester Road
Causeway Bay
Hong Kong

Hong Kong: +852 3915 7000
China: +86 10 5957 4817
Australia: +61 409 527 201
apac@vocollect.com

Vocollect Latin America

North: +52 55 5241 4800 ext 4915
South: +1.412.349.2477
latin_america@vocollect.com

Vocollect Japan

Shiba 2-Chome Bldg 8F
2-2-15 Shiba, Minato-ku
Tokyo 105-0014 Japan

Japan: +81 (0) 3 3769 5601
japan@vocollect.com

Vocollect Singapore

151 Lorong Chuan
#05-02A/03 New Tech Park, Lobby C
Singapore 556741

Singapore: +65 6305 2369
India: +91 124480 6738
singapore@vocollect.com

www.vocollectvoice.com

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