

# ***Hearing Damage Related to In-Ear Music Devices and Other Consumer Products***

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***With Respect to Hearing:  
What Is Safe?  
Are Personal Listening Devices Safe?***

- One Word Answer
  - Depends
- Two Word Answer
  - Yes and No
- Complicated Answer
  - Involves Cramming Foam into Your Ears

# Hearing Loss A Stochastic Process



Table 3-4. Comparison of models for estimating the excess risk of material hearing impairment at age 60 after a 40-year working lifetime exposure to occupational noise, by definition of material hearing impairment

Average exposure level (dBA)	0.5-1-2-kHz definition			1-2-3-kHz definition			1-2-3-4-kHz definition			
	1971-ISO	1972-NIOSH	1973-EPA	1990-ISO	1997-NIOSH	1972-NIOSH	1990-ISO	1997-NIOSH	1990-ISO	1997-NIOSH
90	21	29	22	3	23	29	14	32	17	25
85	10	15	12	1	10	16	4	14	6	8
80	0	3	5	0	4	3	0	5	1	1

CRITERIA FOR A RECOMMENDED STANDARD

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

# *Simplifying the Mess*

**Table 3-4. Comparison of models for estimating the excess risk of material hearing impairment at age 60 after a 40-year working lifetime exposure to occupational noise, by definition of material hearing impairment**

Average exposure level (dBA)	0.5-1-2-kHz definition		1-2-3-kHz definition		1-2-3-4-kHz definition	
		1997-NIOSH		1997-NIOSH		1997-NIOSH
90		23		32		25
85		10		14		8
80		4		5		1

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# *What Is SAFE Noise Exposure?*

- EPA
  - 70dBA Leq(24); 75 dBA Leq(8)
- WHO
  - 75 dBA Leq(8)
- NIH Consensus Document
  - 75 dBA Leq(8)

# *Safe vs. ??????*

- Safe vs. Dangerous
  - Librarian at the Monastery
- Safe vs. Permitted / Safe = Permitted
  - Common Mistake
  - Common Abuse
- Safe vs. Increasing Risk

# *What Are PERMITTED Noise Exposures?*

- OSHA
  - 90 dBA Leq(8), 5 dBA Exchange Rate
- EU Directive 2003/10/EC
  - 80/85 dBA Leq(8)...
- What Should Be Permitted?
  - NIOSH
    - 85 dBA Leq(8), 3 dBA Exchange Rate

# *Safe vs. Increasing Risk Hearing Loss Risk Danger Scale*

<i>Noise Exposure Level</i>	<i>Noise Level</i>	<i>Exposure to Risk of Hearing Damage</i>	<i>% with Damage From Lifetime Exposure</i>	<i>Recommended Action</i>
Safe	< 75 dBA Leq(8)	Unlikely	~0	Use Normal Caution
Moderate	Between 75 and 80 dBA Leq(8)	Possible: Depending on a Number of Factors, Including Other Noise Exposures During Day and Lifetime, Genetics, Ototoxic Drug Interactions, Previous Hearing Loss, etc	1-5% (80 dBA)	Use Hearing Protection/Conservation if Exposed to Noisy Environments, Genetic History of Hearing Loss, Exposure to Ototoxins, Previous Hearing Loss, etc.
High	Between 80 and 85 dBA Leq(8)	Likely	8-14% (85 dBA)	Use Hearing Protection/Conservation
Extreme	> 85 dBA Leq(8)	Certain	23-32% (90 dBA)	Use Hearing Protection and Agressively Seek to Minimize Exposure

# *Adjustments for Products and Events*

- World Is Noisy
  - Many People Have Noisy Workplaces
    - 30 Million Americans Exposed to Potentially Dangerous Workplace Noise
  - Many People Have Noisy Hobbies, Recreation Activities, etc.
    - 20 Million Americans Exposed to Potentially Dangerous Recreational Noise
- Many People Will Have Already Exceeded Their Daily Dose Before Using Product
- No Product Is Entitled to the Entire Dose
  - Multiple Safe Exposures Can Be Dangerous

# *Adjustments for Products and Events*

- If Dose Is Already Met
  - Reduce Noise Levels by 10 dBA
- If Dose Is Shared with Another Exposure
  - Reduce Noise Levels by 3 dBA

# *Hearing Loss Is a Function of Loudness and Time of Exposure*

<b>Time of Exposure</b>	<b>Safe Noise Level</b>	<b>Noise Level</b>
8 Hours	75 dBA	85 dBA
4 Hours	78 dBA	88 dBA
2 Hours	81 dBA	91 dBA
1 Hour	84 dBA	94 dBA
30 Minutes	87 dBA	97 dBA
15 Minutes	90 dBA	100 dBA
7.5 Minutes	93 dBA	103 dBA
3.75 Minutes	96 dBA	106 dBA

# *Personal Listening Devices Or Other Consumer Products*

- How Loud?
- How Long?

# *How Loud Are Personal Listening Devices?*

- 91-120 dBA
  - B. J. Fligor, L. C. Cox, “Output levels of commercially available portable compact disc players and the potential risk to hearing,” *Ear Hear.*, 2004 Dec; 25(6), 513–527.
- ~100 dBA
  - Update by Fligor and Portnuff
- 110 dBA
  - Williams

# *How Long Are Personal Listening Devices Used?*

- Study of 681 10-19 Year Olds
- 50% Listened < 1 Hour/Day
- 10% Listened for 4 or More Hours/Day
  
- H. Ising, J. Hanel, M. Pilgramm, et al., “Risk of hearing loss caused by listening to music with head phones,” HNO 1994 Dec; 42 (12), 764–768.

# *Personal Listening Devices How Long and How Loud?*

- Study of 681 10-19 Year Olds
  - 55% < 66 dBA Leq(8)/Day
  - 7% > 95 dBA Leq(8)/Day
  - 4% > 105 dBA Leq(8)/Day
- 
- H. Ising, J. Hanel, M. Pilgramm, et al., “Risk of hearing loss caused by listening to music with head phones,” HNO 1994 Dec; 42 (12), 764–768.

# *Personal Listening Devices How Long and How Loud?*

- Study of 55 Adults Listening in Noisy Environments
- Males Average of 80.6 dBA Leq(8)
- Females Average of 75.3 dBA Leq(8)
- 25% > 85 dBA Leq(8)/Day
  
- W. Williams, “Noise exposure levels from personal stereo use,” *International Journal of Audiology*, 2005, April; 44, 231–236.

# *Typical Study Conclusions*

- For the *majority or typical users* there is no significantly increased risk of hearing loss due to personal listening devices alone
  - W. Williams, “Noise exposure levels from personal stereo use,” *International Journal of Audiology*, 2005, April; 44, 231–236.
- 15-25% of the users listen at levels above the level of risk deemed acceptable by work place regulations
  - D. Hammershøi, R. Ordoñez, K. Reuter, “Hearing damage by personal stereo: A literature review,” 2006 INCE

# *Dangerous Trends*

- Longer Listening Times
  - Not Limited by Number of Tape One Can Carry
- Listening in Noisy Environments
  - Subway, Mowing, Workplace, etc.
  - If Background above 72 dBA, Personal Listening Device above 85 dBA
- Ear Buds vs. Ear Plugs
- MP3 Players Have Much Greater Market than Walkmans
- Longer Exposure at Younger Ages

# *Limitations*

- Few Studies
  - ~20
- Small Sample Size
- Don't Know Future Use of Personal Listening Devices

# *Conclusions*

- Personal Listening Devices Are Capable of Producing Hazardous Noise Levels in the Ear
- Typical Users Are Not at Risk of Hearing Loss
- A Significant Percentage of Users Are at Risk of Hearing Loss (15-25%)