

**NOISE-INDUCED HEARING LOSS IN THE AVIATION MAINTENANCE INDUSTRY**

This term-paper makes reference to the companies dedicated to the maintenance and repairing of parts for aircrafts.

**THE PROBLEM**

The company that hired me as a Quality Consultant (VHL Aircraft) is a relatively small organization. They have no more than 79 employees, most of them are technicians or professionals in their field (mechanics, electricians and electronics) with an administrative staff, the Support Staff which includes the Information Dept. (Files and Magnetic Backup), the Computer Network staff and the Calibration Dept., in charge of measurement equipment. There was a need for a Quality Assurance Dept., due to the fact that the FAA has very strict quality requirements, including traceability of all parts and a record of maintenance provided to each one of them. However, the company does not have an Occupational Health Department, and therefore, some of the human factors are ignored by the management. Now, during the month of February 2003, the insurance company provided their annual physical exam to all the employees and among the information that the company collected about the employees, was that there has been a decline in the hearing capacity of some of the employees, particularly those performing repairs on the mechanical parts and turbine repairs. The insurance company found that 74% of the 14 employees in the Mechanical/Hydraulics Dept were suffering from such a decline compared to the results of the previous year.

**THE ASSESSMENT OF THE SITUATION**

We did not understand the causes of this event, since the company provides technicians with hearing protectors, so the Quality Dept. started an investigation on the subject. To begin with, we defined the problem in general terms, and we found that hearing loss caused by noise is one of the most common occupational problems in the USA. According to OSHA. Approximately 30 million people in the U.S. are occupationally exposed to hazardous noise. About 10 million people have noise-induced hearing loss, nearly all of which were caused by occupational exposures. We also found that noise-induced hearing loss is insidious and permanent. It can cause isolation at home and socially, and can decrease efficiency at work. (See Reference No.1)

The noise damages the ear in the following way:

- Noise destroys delicate nerve cells in the inner ear that transmit sound messages to the brain.
- The nerve cells are replaced by scar tissue which does not respond to sound.
- The damage is painless but permanent and there is no cure.
- Hearing aids are of some help but cannot restore normal hearing

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(See Graphic No. 1)

High-pitched sounds such as consonants, and women's and children's voices, are the most affected by hearing loss. Thus, while some sounds are still loud, others are filtered out and speech cannot be understood. With more than one person speaking or a background noise the problem is worsened.

Considering the wellbeing of its employees and the fact that if the problem was not corrected, the insurance company might raise the premium for year 2004, we at VHL, decided to find the origin of this situation and find a list of the possible solutions. Subsequently, a consulting company was hired to measure the levels of noise in the workshops (the walls of the offices are sound-proof) and it was found that the values of noise (in dB) oscillated between 86 and 105 dB, depending on the working area and of course, the highest levels were found where turbine components are tested.

## **THE SOLUTION**

According to our textbook, (Ergonomics, by Kroemer et. al., 2001) there are 3 strategies in the prevention of NIHL (Noise-induced hearing loss):

1. **Avoid generation:** The generation of the noise cannot be eliminated or reduced. The cost of the replacement of the equipment for more silent one or the isolation of the testing devices is not financially viable in a moment when the aviation industry is in crisis.
2. **Leave the area:** Of course, this option from the book was not viable, since the tests must be performed with the presence of the technician, but it could help to prohibit in the working area the presence of personnel who is not directly involved in the testing.
3. **Impede transmission:** It relates to the transmission of the source of noise to the employee (the listener), which was already covered. Again, our textbook divides the HPD's (Hearing Protection Devices) in two categories, the Passive HPD's, made of materials that absorb, dissipate or impede energy flow, which are the ones currently in use by our workers. The other category are the Active HPD's, (see diagram No. 2), which reduce noise by destructive interference at selected frequency bands, and let pass or boost desired bands, such as those needed for speech. And we found that they were particularly useful for the aviation industry. We discovered that their price (see URL in Bibliography, No. 2) oscillated between \$169 and \$199 a piece.

In spite of the fact that the protection offered by the company was not the latest technological advance (cuffs and plugs), this protection should've been enough. The workers were then observed in their normal environment for the periods when the tests

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of the repaired parts were performed, and it was discovered that frequently, they held conversations about the part being analyzed and the hearing protection was removed for better understanding of these conversations. The protection was removed sometimes for long periods of time, even in cases where the interaction with colleagues was already over.

We then realized of the origin of the situation, but we also understood the need that the technician had to communicate ideas and receive feedback from colleagues *in situ*. So, it seemed that the best option would be the active HPD's.

In addition to our findings, the insurance company advised a Noise Control Program, so we assembled one under their guidance; and mutually agreed that, when technically possible, the first and the third part of such program would be under their responsibility, otherwise VHL will be referred to a consulting group, recommended by the insurance company.

1. **Hearing Testing:** All technicians should be tested, but especially those involved in the testing activities. These tests would measure how loud a sound has to be before the subject barely hears it. Periodical evaluations determine if there has been a deterioration of hearing capabilities.
2. **Noise Measurement:** It is done with a sound pressure level meter for measuring continuous noise. In a situation where the noise is intermittent or where the employees are moving in and out of the noise environment, a noise dosimeter may be needed to measure accurately
3. **Training and Documentation:** The insurance company through seminars and printed materials will provide the employee with information about the hearing conservation program and give them opportunity to ask questions and be well informed, including an explanation of test results, informing the employee about normal hearing, hearing loss, how hazardous noise can cause hearing loss, and how hearing protectors work.
4. **Hearing Protection:** It is now under consideration (and I would say imminent) the purchase of active HPD's.

The Production Manager would be in charge of keeping the personal records of the hearing capacity of each of the employees involved, to estimate progress (or lack of it).

To make sure that the employees involved were aware of the situation and the importance of an improvement in it, there has been discussion of additional measures *a la* Skinner. I proposed a stimulation program that consists of the following:

- The employees who successfully assimilate their responsibilities in the Hearing Protection Program will be issued a waiver. Waivers will be necessary for renewal of contract.

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- If an employee is surprised at operation times or running tests without the due hearing protection at least 3 times, he or she will have to take a Hearing Loss Awareness Course (provided by a consulting company) and pay it out of his/her own pocket.
- If the employee persists in his/her behavior, his/her health benefits (The Company pays 100% of health insurance premiums) will be partially removed and the employee would have to pay for a percentage of it.

The third point is particularly difficult, and initially was not very welcome by management, due to its legal implications, since this particular benefit is product of a labor agreement. However, according to our legal advisors, if the employee neglects his/her own safety in the workplace with activities that endanger his/her wellbeing, there might be a chance that this measure can be applied without fear that the company might get sued.

**CONCLUSIONS**

We arrive to the following conclusions, activities that must be done, regarding the position of the company about the problem of its employees reducing their hearing capacity originated by the performance of their duties in the organization:

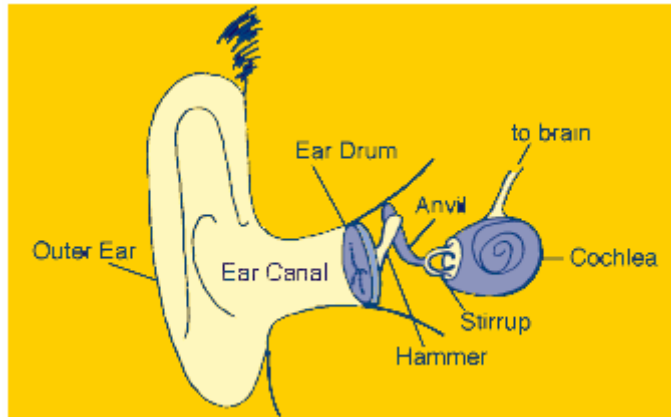
- Implementation of an informative and educational campaign is a priority. It will include the scientific background, as well as explanation on the new corporate policies regarding the subject. Every new employee will receive this information as part of their initial training.
- Develop a monitoring system for the fulfillment of the implemented regulations that will include periodical physical examination of the employees.
- Purchase of active HPD's for the most exposed employees on a trial basis, and see if it contributes to their performance and protection, and if it suits the company's needs
- Expand the network of cooperation with the insurance company and the consulting companies it recommends to achieve the goal. The money spent on the consulting activities will be well invested, since it's for the health of the employees and constitutes savings on the long run for the organization.
- Consider this a first step in the creation of additional activities to enhance the occupational safety conditions of all the employees, with the eventual goal of creating a position for someone whose job description will be to supervise and manage occupational risks.

**REFERENCES**

- (1) [http://www.safetynext.com/library/article/index.cfm?articles\\_id=2877&subs\\_id](http://www.safetynext.com/library/article/index.cfm?articles_id=2877&subs_id)
- (2) [http://www.headsetsinc.com/price\\_list.htm](http://www.headsetsinc.com/price_list.htm)
- (3) <http://www-personal.umich.edu/~lusk/sallynihl.html>
- (4) <http://www.hec.afrl.af.mil/HECB/hecbP8.shtml>
- (5) Kroemer, Kroemer and Kroemer-Elbert (2001) Ergonomics 2. 204, 212

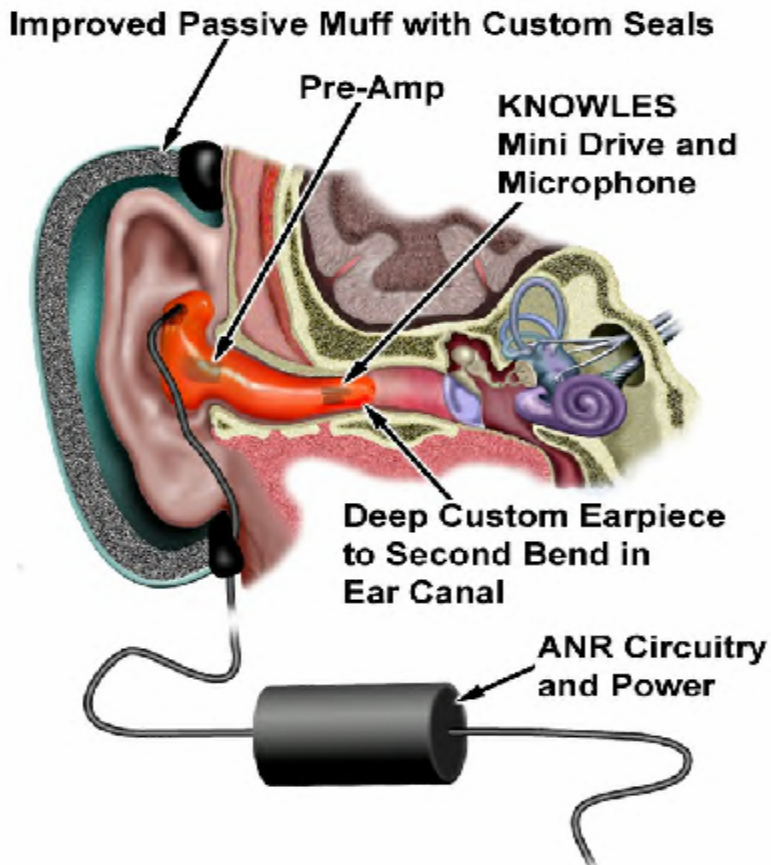
**GRAPHICS**

**Graphic No.1: The human ear**



Source: URL No.3 IN THE REFERENCES LIST

**Graphic No. 2: Active HPD**



Source: URL No 4 IN THE REFERENCES LIST