Non-traditional Noise Sources: Dosimeter studies of Crowd Noise with Special Reference to Industrial Hygienists’ Exposures

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2006 AIHCE, Chicago, IL
A ‘modest proposal’:

That an experiment be performed in conjunction with the 2005 AI HCE to wit:
That we will measure noise exposure during the MSA cocktail party
That we will determine variability of self-generated noise
That we will compare instrumentation
That we will compare noise dose in the following ways
  Circulating clockwise
  Circulating counterclockwise
  Remaining in place
That we will compare noise levels in the following ways:
  Noise vs time since start
  Noise vs room population
  Noise vs cocktails served
That we will allow IH’s to predict noise levels and/or doses (a la Neil Hawkins)
That we will publish the results in the Journal
That we will award prizes, or better yet, raise money for the foundations (AI HF and FOHS) with the results

This started as a joke; See the proposal below…
Real questions to be asked

- Is the noise level at the MSA cocktail party as loud as we all have suspected?
- Can we estimate our own exposures in the midst of it?
- Do I.H.s have a sense of humor?
Contents

- Part 1
  - The 2005 AI HCe MSA Reception
    - Method
    - Results
    - Discussion
    - Conclusions

- Part 2
  - Human Factors: the ‘cocktail party effect’
  - Particle Physics: the Higgs Boson explanation

- References
- Questions
Method

- Quest M27 dosimeters calibrated before and after
- Dosimeters worn by 5 CIH attendees (the author plus four current or former colleagues)
- Dosimeters turned on and worn for the length of the party
- Dosimeters read within 2 hours of the end of the party
Results: What the Data looked like:

<table>
<thead>
<tr>
<th>QUEST M-27 NOISE LOGGING DOSIMETER</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAME: Scotty Butter</td>
</tr>
<tr>
<td>I.D. #: 5</td>
</tr>
<tr>
<td>WORK STATION</td>
</tr>
<tr>
<td>COMMENTS</td>
</tr>
</tbody>
</table>

CAL LEVEL: 110.1 dB  UNIT: 1
START TIME: 00:00H:M  END TIME: 04:55H:M
PEAK LEVEL: 133.8 dB  MAX LEVEL: 117.3 dB  MIN LEVEL: 79.1 dB  UPPER LIMIT: 115 dB
PEAK TIME: 02:17H:M  MAX TIME: 02:45H:M  MIN TIME: 01:54H:M  UL TIME: 00:01

EXCHANGE RATE: 5 dB  --90 dB THRESHOLD
CRITERION: 90 dB  LAVG: 87.8 dB
RANGE: 50 dB  TWA: 74.0 dB
TIME CONSTANT: SLOW
WEIGHTING: A  8 hr DOSE: 74.1 dB

--90 dB THRESHOLD  5 dB EXCHANGE RATE

<table>
<thead>
<tr>
<th>1 MIN HISTOGRAM</th>
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<tbody>
<tr>
<td>00:00 00 00 00 00 00 00</td>
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<tr>
<td>00:05 00 00 00 00 00 00</td>
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<tr>
<td>00:10 00 00 00 00 00 00</td>
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<td>00:15 00 00 00 00 00 00</td>
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<td>00:35 00 00 00 00 00 00</td>
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<td>00:40 00 00 00 00 00 00</td>
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<td>00:45 00 00 00 00 00 00</td>
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<td>00:50 00 00 00 00 00 00</td>
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</tbody>
</table>

--80 dB THRESHOLD  3 dB EXCHANGE RATE
LAVG: 90.8 dB  LEQ: 92.2 dB  TWA: 77.0 dB  SEL: 128.4 dB
DOSE: 16.59%  DOSE: 24.39%  8 hr DOSE: 113.5%  8 hr DOSE: 166.8%

FEB 22 2006
Graphic results:
One minute histograms

Time elapsed vs Sound Level

- Sample I
- Sample G
- Sample F
- Sample J
## Peak Results
(with comparison to Sweetow, 2000 results)

<table>
<thead>
<tr>
<th>Type</th>
<th>L-AVG</th>
<th>Max (dBA)</th>
<th>Peak (dB SPL Unweighted)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample F</td>
<td>92.2</td>
<td>109.1</td>
<td>145.5</td>
</tr>
<tr>
<td>Sample J</td>
<td>90.8</td>
<td>117.3</td>
<td>133.8</td>
</tr>
<tr>
<td>Sample G</td>
<td>88.1</td>
<td>101.6</td>
<td>116.6</td>
</tr>
<tr>
<td>Sample I</td>
<td>83.4</td>
<td>107.2</td>
<td>141.7</td>
</tr>
<tr>
<td><strong>Restaurant/Bar</strong></td>
<td>90.1</td>
<td>104.6</td>
<td>142.1</td>
</tr>
<tr>
<td><strong>Restaurant</strong></td>
<td>86</td>
<td>103.5</td>
<td>125.2</td>
</tr>
<tr>
<td><strong>Restaurant</strong></td>
<td>83.2</td>
<td>109.8</td>
<td>145.1</td>
</tr>
<tr>
<td><strong>Family Restaurant</strong></td>
<td>71.5</td>
<td>94.8</td>
<td>128.2</td>
</tr>
<tr>
<td><strong>Elegant Bistro</strong></td>
<td>50.5</td>
<td>85.5</td>
<td>105.3</td>
</tr>
</tbody>
</table>
Comments on this Measurement Process

- Security and permission
  - Who to ask
  - Carrying sampling equipment on public transportation
  - Security measures in conferences

- Use of CIHs as subjects
  - ‘doctors as patients’
IH predictions of levels

I.H. guesses as to noise level

Highest Measure
92dB

Lowest Measure
83dB
On IH predictions

- Everyone asked for a prediction came up with one...
  - Only 7 out of 70 people made any clarification or comment on their guess.
  - Of the almost 70 predictions, 30% predicted to a tenth of a decibel...
  - Only 3 people gave a range for an answer
  - Only one was observed (plus one that phoned later) to be wearing hearing protection
Discussion questions

- Which form of result (Average sound level, peak level, etc.) has meaning for exposure calculations or hearing loss predictability?
- What controls should be used for these types of exposures?
- What should we make of I.H.s apparent lack of curiosity?
Conclusions and further research

- The noise level at the MSA cocktail party is in fact as loud as we have all suspected; maybe even louder
- Yes, we can estimate our own exposures; however, we need to review our lessons in accuracy and precision.
- Yes, at least some I.H.s have a sense of humor
Another ‘modest proposal’ is called for:
- We need a noise exposure database of exposures that can be compared, therefore:
  - More of us need to measure non-workplace noise levels, using accepted protocols
The cocktail party effect: Fish and human brains perform 'auditory scene analysis' when looking for love in all the loud places

Cornell biology professor Andrew Bass records sounds of midshipman fish during summer mating season along the Washington state coast. 

Photo by Margaret Marchaterre, Copyright © 1998
Particle Physics: The Higgs Boson One Page Explanation


Miller, D.  *A Quasi-political Explanation of the Higgs Boson; for Mr. Waldgrave, UK Science Minister* 1993 (artwork by CERN)  *Physics World*  Vol. 6 No. 9, 1993

Sweetow, R.W. and Tate, L.M.  *I’ll Have a Side Order of Earplugs, Please*  *Audiology Today*, May/June 2000