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A REAL-WORLD ASSESSMENT OF NOISE EXPOSURE

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JOINT EPA/USAF STUDY

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The voluntary informed consent of the subjects used in this research was obtained as required by Air Force Regulation 80-33.

This report has been reviewed by the Information Office (OI) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

This technical report has been reviewed and is approved for publication.

FOR THE COMMANDER

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The noise exposure of 50 individuals was continuously monitored for 7 consecutive days, by means of personal noise dosimeters. Over the 7 days of the test, average $L_{eq(24)}$'s (or what could be termed $L_{eq(week)}$'s) among these individuals ranged from a low of 66 dB to a high of 85 dB, with a median of 74.7 dB. Over 80 percent of the individuals had average $L_{eq(24)}$'s greater than the minimum level of 70 dB identified by the Environmental Protection Agency to protect public health and welfare with an adequate margin of safety (EPA

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1974). Yet, with one exception, all of these individuals had average $L_{eq(24)}$'s that were less than the minimum that would be exhibited by a worker who, during the working week, was exposed to the maximum level permissible under OSHA's current noise exposure regulation. Surprisingly enough, the highest average $L_{eq(24)}$ was not exhibited by a worker, but was exhibited by a 13 year old school boy.

SUMMARY

The noise exposure of 50 individuals was continuously monitored for 7 consecutive days, by means of personal noise dosimeters. Over the 7 days of the test, average $L_{eq(24)}$'s (or what would be termed $L_{eq(week)}$'s) among these individuals ranged from a low of 66 dB to a high of 85 dB, with a median of 74.7 dB. Over 80 percent of the individuals had average $L_{eq(24)}$'s greater than the minimum level of 70 dB identified by the Environmental Protection Agency to protect public health and welfare with an adequate margin of safety (EPA 1974). Yet, with one exception, all of these individuals had average $L_{eq(24)}$'s that were less than the minimum that would be exhibited by a worker who, during the work week, was exposed to the maximum level permissible under OSHA's current noise exposure regulation. The highest average $L_{eq(24)}$ was not exhibited by a worker, but was exhibited by a 13 year old school boy.

Although the range of $L_{eq(24)}$'s observed among the participants in this study is more restricted than that of the entire population, the mean 7-day average $L_{eq(24)}$ probably does not differ drastically from the population's. Therefore, the typical individual, over the course of a week, probably has a 7-day average $L_{eq(24)}$ in the neighborhood of 75 dB.

PREFACE

The research described in this technical report was accomplished under Contract F33615-75-C-5055 with the University of Dayton Research Institute. Although there have been numerous estimates as to what constitutes the typical individual's daily noise exposure, these estimates have been based upon samples of the individual's noise exposure rather than upon continuously monitoring his exposure over some representative time period. In this investigation, the noise exposure of 50 individuals was continuously monitored, by means of personal dosimeters, over 7 consecutive days.

The work described in this report was supported by The Environmental Protection Agency and the Biological Acoustics Branch, Biodynamics and Bioengineering Division of the Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio.

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SECTION 1
INTRODUCTION

The U.S. Environmental Protection Agency (EPA) has published information on levels of environmental noise requisite to protect public health and welfare, however, similar information is not available on the noise exposure actually experienced by various segments of the population. A next logical step in the overall program to promote environments free from adverse effects of noise is an adequate description of the total noise exposures experienced by the public for a large number of different situations. This total noise exposure must include realistic descriptions of non-occupational as well as occupational situations.

Wearable, personal noise dosimeters provide the instrumentation capability for describing total noise exposure in a very wide range of situations and of exposure durations. Although the merits and limitations of numerous noise dosimeters are described in the literature (Dear, 1973; Wilkerson, 1975; Giardino & Seiler, 1976; Seiler, 1977; Heggie, 1977), very little information is available on their use outside the occupational situation.

The general purpose of this study was to describe the total noise exposure of five groups of individuals over a period of seven days as a prelude to establishing typical total noise exposures. Inherent in the effort was the development of noise exposure assessment methodology using dosimeters, the evaluation of selected noise dosimeters and their calibration procedures, and the interpretation of the noise dosimeter measurements.

Among the few sources of information on the use of noise dosimeters in typical occupational and non-occupational situations is the precursor to the present investigation (Johnson and Farina, 1976), wherein the noise exposure of a medical technician was monitored by a dosimeter for 31 consecutive days, 24 hours per day. Over this period, that individual was exposed to an A-weighted average sound level of 76 dB while his daily $L_{eq(24)}$'s ranged from 59 to 83 dBA.

In another study (Sone, Nimura and Kono, 1977), the noise exposures of 45 Japanese housewives and 36 workers were monitored for a 24 hour period. Although the ranges of $L_{eq(24)}$'s were not included, the reported mean $L_{eq(24)}$ was 68.6 dB among the housewives and 72.7 dB among the workers. The Environmental Protection Agency (EPA, 1974) describes the long-term consequence of a daily noise exposure of $L_{eq(24)}$ of 73 dB to be a 96^{th} percentile permanent threshold shift (PTS) of 5 dB at 4000 Hz. Consequently, a daily exposure of $L_{eq(24)}$ of 70 dB should produce virtually no significant noise-induced PTS in the general population.

The majority of workers in the Japanese study experienced $L_{eq(24)}$'s that exceeded the EPA recommendation of 70 dB, as did a substantial proportion of the housewives, assuming that the L_{eq}'s were distributed in a fairly normal manner. Thus, it appears that a sizable number of these individuals are regularly exposed to noise levels that are potentially harmful, provided that the observed L_{eq}'s were typical exposures.

It is questionable, though, whether a single 24-hour period is representative of an individual's usual exposure. Then too, the typical Japanese exposure may be quite different from the typical American exposure. Therefore, the present investigation was designed to continuously monitor the noise exposure of 50 Americans, over 7 consecutive days. Even with this longer monitoring time, a sample size of 50 is not large enough to represent the full range of life styles experienced in America. For this reason, this investigation is best classified as a "feasibility study". Nevertheless, the data provided in this investigation should give the reader an insight into the types of noise exposures that are now occurring in the real-world.

SECTION 2
METHOD

A. APPROACH IN BRIEF

The noise exposure of each of 50 individuals was continuously monitored over 7 consecutive days by means of personal noise dosimeters. The individual's noise dose was read and recorded every day at about 8 A.M. and 5 P.M., which enabled daily, daytime (8 A.M. to 5 P.M.), and night-time (5 P.M. to 8 A.M.) equivalent continuous sound levels to be calculated for each individual for each day of the 7-day test period.

B. SUBJECTS

Subjects were 50 volunteers, representing five occupational groups: factory/commercial worker, office worker, homemaker, pre-college student, and college student. For each occupational group 5 males and 5 females were selected to participate. These subjects, who ranged in age from 5 to 52 (with a median of 22.4 years), were paid for their participation. Preliminary to selection, potential subjects read a brief description of the study, made ratings on 6 subjective variables, and signed a declaration of voluntary informed consent.

Initially, volunteers were recruited through advertisements that had been placed in local and campus newspapers. As the study progressed, though, many additional volunteers were recruited through their contacts with friends, associates, or family members who had already participated in the study. A volunteer was selectef for participation if his (or her) occupation and sex coincided with those needed to fill the requirements of a particular occupational group. With respect to the factory/commercial occupational category, the selection process may have prevented individuals with very intense noise exposures from volunteering. Since the term "factory/commercial worker" may convey the impression that the worker is necessarily exposed to relatively high intensity occupational noise and since in any case it is difficult to classify occupations into factory, industry, construction, etc, the actual job descriptions are provided for each of the 10 subjects listed in this category. The job descriptions of these subjects, listed as subjects 1-10 in Appendix A, are:

7-Day Energy Average $L_{eq(8)}$	Factory/Commercial Worker No. (Sex, Age)	Type of Job
77.8	1 (Male, 54)	Production line employee in an automotive tire manufacturing facility.
82.7	2 (Male, 47)	Sheet metal worker, in a sheet metal shop.
73.8	3 (Male, 38)	Technician, works with hydraulic pumps.
78.7	4 (Male, 31)	Technician, works with man-rated vibration platforms.
86.0	5 (Male, 27)	Technician, works in meter repair shop around high pressure air hoses and valves.
74.2	6 (Female, 45)	Production line employee, automotive assembly plant.
71.5	7 (Female, 20)	Works in construction area, cleaning out newly constructed homes.
70.0	8 (Female, 21)	Production line employee for an electronics company, assembling switch components.
70.4	9 (Female, 17)	Works in a laundry.
79.1	10 (Female, 44)	Production line employee, automotive assembly plant.

C. PROCEDURES

The subject's noise exposure was continuously monitored for 7 days by means of a noise dosimeter which, during waking hours, was worn on his person. He was free to attach the dosimeter in whichever of several ways (e.g., clipped to his belt, in a pocket, in a case suspended from a shoulder strap) that proved to be most comfortable. The dosimeter's microphone, however, was always worn outside of the subject's outer garments, generally between his breast and shoulder.

For sleeping purposes, the subject was instructed to remove the dosimeter and place it nearby, as close to his head as possible. Likewise, while engaged in strenuous activities (such as football or basketball) or in other activities that precluded wearing the dosimeter (like taking a shower), the subject was also instructed to remove the dosimeter and place it nearby.

Although three different types of dosimeters were used in conjunction with this investigation, their basic operation was identical. Above some threshold intensity, they accumulated "counts" at a rate proportional to noise intensity in accordance with the 3 dB doubling (equal energy) rule.

In a calibration check, it is determined how many counts are accumulated per unit of time when the dosimeter is exposed to a sound source of known intensity. Knowing this, counts accumulated when the dosimeter is actually worn can readily be converted into $L_{eq(t)}$, where $L_{eq(t)}$ is the equivalent continuous sound level for the time period, t, being considered. The conversion equation is shown below:

$$L_{eq(t)} = 10 \log \left(K \cdot \frac{C}{t}\right), \text{ where}$$

t = time, in seconds, dosimeter was worn

C = counts accumulated during that interval

$K = (10^{I})/C_o$

I = intensity, in Bels of sound source used in calibration check

C_o = counts accumulated per second during calibration check.

The dosimeters used in this project incorporated "A-weighted" frequency networks.

Prior to providing the subject with the dosimeter he would be using during the test, the experimenter inserted new batteries and checked the dosimeter calibration. For the calibration check, which was repeated 5 times, the experimenter exposed the dosimeter to a 1000 Hz tone for 68.3 seconds at 94 dB. During the 7-day test, the batteries were replaced every day or two (depending upon the type of dosimeter), either by the experimenter, the subjects, or, in the case of very young children, by the subject's parents. At the end of the test period, before replacing the batteries, the experimenter checked the dosimeter's calibration an additional 5 times. From the total counts accumulated during the pre- and post-test calibration checks the mean number of counts per calibration check was calculated, which was used as the constant, C_o, in calculating L_{eq}'s.

In preparation for the 7-day test, the experimenter familarized the subject with the dosimeter and provided him with noise exposure recording sheets on which to record his noise exposure data. During the test, a reading was taken from the dosimeter and recorded at least twice a day. If the subject was provided with a self-reading dosimeter, he was instructed to read it each day at 8 A.M. and 5 P.M., or as closely to those times as possible. If the dosimeter was not a self-reading variety, the subject was either taught to operate a separate readout device or the experimenter arranged to make the necessary readings himself. The subject was also requested to note his daily activities and to make additional readings during those periods that he was engaged in particularly noisy activities, at least if he were provided with a self-reading dosimeter.

At the conclusion of the 7-day test, the subject was required to make several additional subjective ratings. Also, his hearing threshold level was determined using a Tracor ARJ-4 Bekesy-type, self-recording, audiometer. He was first given a practice test in his right ear at frequencies of .5, 1, 2, 3, 4, and 6 KHz, followed by a full test at those frequencies in both ears -- starting with the left ear.

D. DOSIMETERS USED

Three types of dosimeters were used in conjunction with this project: (1) Brüel and Kjaer (B&K) Model 4424; (2) Loomis Laboratories Model 3573; and (3) Computer Engineering Model 122. Of the 50 subjects who participated in the project, 30 subjects wore a B&K dosimeter, 15 wore a Loomis Laboratories dosimeter, and 5 wore a Computer Engineering dosimeter. Each of these dosimeters had its strengths and weaknesses.

Brüel & Kjaer: This dosimeter had a dynamic range of 50 dB. It could be used with either a 30 dB, 16 dB, or no preamplifier -- giving it a threshold of approximately 50, 65, or 80 dB. The subject was initially provided with a 16 dB preamplifier. If this preamplifier was not optimal for the noise exposure he experienced during the first day of the test, he could be switched to either a 30 dB preamplifier or to no preamplifier. Although it was necessary to switch some subjects to the 30 dB preamplifier, no subject was switched to no preamplifier.

Because of its size (11.5 x 7.5 x 3.3 cm) and weight (280 g), the B&K dosimeter was somewhat cumbersome to wear. Yet, this negative aspect was more than compensated for by the fact that this dosimeter incorporated a digital readout capability that permitted the subject to readily monitor his own noise exposure. Not only did this feature simplify the experimenter's task, but it apparently enticed numerous subjects into participating in this project--individuals who wanted some on-going indication as to the severity of the noise to which they were exposed.

Loomis Laboratories: Due to the size (8 x 5 x 1.5 cm) and weight (70 g) of this dosimeter, the Loomis Laboratories dosimeter was by far the most comfortable to wear. In fact, when it was clipped to the subject's shirt or in his pocket, he could easily forget that he was even wearing it.

Although the Loomis Laboratory dosimeter's dynamic range, 45 dB, was satisfactory, it's threshold, 74 dB, was somewhat higher that was desirable, especially since noise intensity associated with some waking activities may well be less than 74 dB. However, unless the subject's normal activities exposed him regularly to intensities very close to the threshold value, this would have had only minor effects on his daily L_{eq}'s. The fact that this dosimeter could not be read directly was troublesome. It necessitated that a rather large readout unit be connected to the dosimeter whenever readings had to be taken. This time-consuming procedure (5-10 minutes) required that the experimenter either arrange to take the readings himself or that he train the subject to take them. Only one subject, a technician, was trained to take his own reading. But since his wife and children were also participants in this study he took their readings as well. For the rest of the subjects using the Loomis Laboratories dosimeter, the experimenter had to arrange to meet them two times a day in order to take the required readings. Although some individuals were occasionally able to come into the University for these readings, it was generally necessary for the experimenter to tote the readout unit to the subject's place of work and/or home.

Computer Engineering: The dynamic range, 60 dB, and threshold, 60 dB, of this dosimeter were more than satisfactory. However, it size and weight (230 g) were only slightly less than that of the B&K dosimeter. Thus, this dosimeter was also somewhat cumbersome to wear. Furthermore, although the Computer Engineering dosimeter has a direct readout capability, the readout was in binary-coded decimal. Since this necessitated training most subjects in reading the device, many subjects were reluctant to use this particular dosimeter. Also, the fact that the microphone was attached with a large (10 mm), inflexible wire served to increase the awkwardness associated with wearing this dosimeter and was responsible for the wire breaking on one occasion.

E. DEPENDENT VARIABLES

Noise Exposure Variables: For each day of the 7-day test, 3 dosimetry variables were calculated for each subject:

1. $L_{eq(24)}$ -- equivalent 24-hour continuous sound level, expressed in decibels (dB). Ideally it was based upon the time interval, 8 A.M. to 8 A.M. However, if the subject, for example, made his first reading on one day at, say 9 A.M., and his first reading on the subsequent day at 8 A.M., the $L_{eq(24)}$ would actually be based on 23 rather than 24 hours.

2. $L_{eq(day)}$ -- equivalent 8 A.M. to 5 P.M. continuous sound level, expressed in dB (adjusted when necessary to coincide with the 8-5 time interval).

3. $L_{eq(night)}$ -- equivalent 5 P.M. to 8 A.M. continuous sound level, expressed in dB (adjusted when necessary to coincide with the 5-8 time interval).

Additionally, an energy average was calculated for each of the three variables over the 7 days of the test. These energy averages are referred to as average $L_{eq(24)}$, average $L_{eq(day)}$, and average $L_{eq(night)}$. But what is an energy average L_{eq}? Operationally, to obtain an energy average L_{eq}:

a. the 7 daily L_{eq}'s are converted into their energy equivalents (by simply taking the antilog_{10} of the L_{eq}'s expressed in Bels);

b. the mean (arithmetic average) daily energy equivalent is calculated; and then

c. the logarithm_{10} of the mean daily energy equivalent is taken, which when multiplied by 10 becomes a 7-day energy average L_{eq}, expressed in decibels.

As a concrete example, suppose that an individual had daily $L_{eq(24)}$'s of 60, 70, 70, 80, 60, 70, and 80 dB. In that case his 7-day energy average $L_{eq(24)}$ would then equal $10 \times \log[(10^6 + 10^7 + 10^7 + 10^8 + 10^6 + 10^7 + 10^8)/7]$, or 75.2 dB which, incidentally is quite different from his mean $L_{eq(24)}$, viz., 70 dB.

Subjective Ratings: Each subject made ratings on 6 subjective variables before the start of the 7-day test. In this way, they rated their relative noise exposure, relative work exposure, preferred music volume, loudness of favorite hobbies/recreation activities, loudness of the one favorite hobby, and the hazardousness of their normal noise exposure. At the completion of the test, they were required to make 3 additional subjective ratings, viz., they rated the percent of time the dosimeter had been used, the degree of inconvenience associated with wearing the dosimeter, and the amount of noise to which they had been exposed during the test, relative to their normal exposure.

Audiometric Variables: All except two of the 50 subjects were given audiometric tests following the 7-day test. One subject, a 5 year old girl, was afraid to go into the audiometric testing chamber. Another subject, a 21 year old, male college student, was never given an audiometric test because agreeable scheduling could not be worked out.

The audiometric test produced hearing threshold levels (HTL's) at frequencies of .5, 1, 2, 3, 4, and 6 KHz for both ears. For data analysis purposes, these were converted into combined HTL's at each frequency -- which is simply the mean of the left and right ear HTL's.

SECTION 3
RESULTS

A. DOSIMETRY

The most important concern of this investigation was "How much noise are people exposed to during the course of their ordinary activities?" In order to answer this question, it was necessary to look at the dosimetry data in a variety of ways.

Daily $L_{eq(24)}$'s: To provide some insight into both the magnitude and variations in noise exposure that the participants in this study were exposed to during course of the 7-day test, $L_{eq(24)}$ data are summarized in Table 1 for each day of the test.

TABLE 1
SUMMARY OF DAILY EXPOSURES
$L_{eq(24)}$, in dB

Day	Mean	SD	Range	50th %ile	90th %ile
Monday	72.8	5.8	62-88	72.8	79.0
Tuesday	74.1	5.3	63-86	74.3	81.2
Wednesday	72.8	5.3	62-85	73.2	80.1
Thursday	73.4	5.3	64-85	74.1	80.2
Friday	74.1	4.7	65-87	74.5	79.4
Saturday	73.8	4.7	63-88	73.6	79.1
Sunday	71.4	5.8	59-85	71.1	78.9
Total [350 $L_{eq(24)}$'s]	73.3	5.3	59-88	73.4	79.8
Average[1] $L_{eq(24)}$	74.5	4.1	66-85	74.7	79.9

[1]Energy Average (for explanation, see the description of the dosimeter variables in the "Method" section).

From inspection of Table 1, it can be seen that the mean and median (50^{th} percentile) $L_{eq(24)}$'s were quite similar -- reflecting the fact that the $L_{eq(24)}$'s were fairly normally distributed. Although $L_{eq(24)}$'s differed significantly among days ($F_{6,294}$ = 3.62, $p < .05$), they did not do so in any particular systematic fashion.

The average $L_{eq(24)}$ is not simply the arithmetic average of the individual's 7 daily $L_{eq(24)}$'s. Instead, it is an energy average, which explains why the mean of the average $L_{eq(24)}$'s is greater than the mean of all 350 individual $L_{eq(24)}$'s. Because average $L_{eq(24)}$ is an energy average, it could appropriately be termed $L_{eq(week)}$ since it is, in fact, an equivalent 1-week continuous sound level. In Appendix A, $L_{eq(24)}$, $L_{eq(day)}$, and $L_{eq(night)}$ scores are shown for each subject for each day of the test as are combined HTL values. The availability of these data will enable the reader to perform additional analyses, if so desired. Also, in Appendix B, the distributions are shown for the 350 (50 participants x 7 days) 24-hour, daytime, and night-time L_{eq}'s. Of the 350 $L_{eq(day)}$'s, which are basically occupational exposures, only two exceeded 90 dB. One of those high $L_{eq(day)}$'s was experienced by a subject on a Saturday while working at home on a jig-saw, not during the work week. The other $L_{eq(day)}$ that exceeded 90 dB was experienced by a subject as a consequence of driving his car while the radio was on.

$\underline{L_{eq(day)} \text{ versus } L_{eq(night)}}$: Concern over potentially hazardout noise exposure has primarily been directed towards occupational noise exposure. Thus, the question that begs to be asked is "How much of the $L_{eq(24)}$ can be attributed to daytime noise exposure (occupational exposure, since the participants all worked day shift) and how much can be attributed to night time exposure?" Accordingly, exposure data are presented for day and night in Tables 2 and 3.

TABLE 2

SUMMARY OF DAYTIME EXPOSURES
(8 A.M. to 5 P.M.)

$L_{eq(day)}$, in dB

Day	Mean	SD	Range	50th %ile	90th %ile
Monday	73.5	6.2	63-92	73.6	80.3
Tuesday	74.9	5.5	62-89	74.2	82.0
Wednesday	73.6	6.2	60-87	73.5	82.5
Thursday	74.2	6.0	57-88	74.1	81.8
Friday	74.2	5.0	63-85	74.1	81.0
Saturday	75.4	5.2	65-92	75.1	80.8
Sunday	72.2	6.2	61-86	72.2	80.8
Total [350 $L_{eq(day)}$'s]	74.1	5.8	57-92	74.0	81.7
Average[1] $L_{eq(day)}$	75.3	4.7	67-86	75.1	82.5

TABLE 3

SUMMARY OF NIGHT TIME EXPOSURES
(5 P.M. to 8 A.M.)

$L_{eq(night)}$, in dB

Day	Mean	SD	Range	50th %ile	90th %ile
Monday	71.6	6.3	58-85	73.6	79.1
Tuesday	72.5	5.6	59-85	73.3	78.9
Wednesday	71.4	6.4	50-83	73.7	77.9
Thursday	71.5	5.8	61-83	71.8	78.7
Friday	72.6	6.3	58-87	73.8	79.8
Saturday	72.0	5.6	57-84	73.8	77.9
Sunday	70.6	6.1	57-84	70.7	77.2
Total [350 $L_{eq(night)}$'s]	71.8	6.0	50-87	73.1	78.6
Average[1] $L_{eq(night)}$	73.6	4.0	65-84	74.6	77.8

In glancing over both the day and night L_{eq}'s, it can be seen that the $L_{eq(day)}$'s are slightly higher than the corresponding $L_{eq(night)}$'s. And, when the average L_{eq}'s were compared by means of a t-test, significant differences ($t_{49} = 4.11$, $p < .05$) were detected. The mean difference between day and night for the people studied was only about 1.7 dB which is of little practical consequence.

$L_{eq(24)}$ and Occupation: It will be recalled that among the participants in this investigation, there were 10 subjects in each of five occupational groups. Average $L_{eq(24)}$ means, in decibels, are shown by occupation below:

Factory/ Commercial	Office	Homemaker	Pre-College	College
74.9	73.4	74.3	76.2	73.5

From inspection of these values, it can be seen that the differences in average $L_{eq(24)}$ among occupations were slight. Although these differences were not significant ($F_{4,45} = 0.75$, $p > .05$), it is of interest to note that the highest average $L_{eq(24)}$'s were associated with the pre-college student group -- a group of youngsters ranging in age from 5 to 16 years. Average $L_{eq(24)}$'s for the factory/commercial workers would suggest that their average occupational environments did not involve intense industrial noise exposure.

$L_{eq(24)}$ and Sex: Average $L_{eq(24)}$'s differed slightly as a function of sex (male - 75.3 dBA; female - 73.7 dBA), however, this difference was not significant ($t_{48} = 1.41$, $p > .05$).

Highest Exposure Levels: From the L_{eq}'s that have been presented so far, it is evident that at least some participants were exposed to fairly high levels of noise during the course of the 7-day test. But who are these individuals? To answer that, those 5 individuals who exhibited the five highest median $L_{eq(24)}$'s were identified. Their exposure data are summarized in Table 4.

Subject 35 -- is a 13 year old boy who exhibited the highest median $L_{eq(24)}$. His relatively high L_{eq}'s can be attributed to the fact that he rode a mini-bike nearly every day after school and, on the weekend as well. His HTL's at each audiometric frequency, however, were less than 0 dB.

TABLE 4
PARTICIPANTS WITH HIGHEST EXPOSURE LEVELS[2]

Subject	$L_{eq(24)}$ Median	$L_{eq(24)}$ Range	$L_{eq(day)}$ Median	$L_{eq(day)}$ Range	$L_{eq(night)}$ Median	$L_{eq(night)}$ Range
35	84.9	83-87	86.5	84-88	83.3	80-88
5	80.9	72-88	83.8	73-92	75.7	65-84
39	80.6	74-86	83.5	67-88	78.1	62-82
2	79.2	76-84	81.6	78-87	77.2	75-79
24	79.3	76-82	82.3	76-84	74.0	74-81

Subject 5 -- is a 27 year old male factory/commercial worker, who works in a meter repair shop around high pressure air hoses and valves. His $L_{eq(day)}$'s were, with the exception of Sunday, considerably higher than his $L_{eq(night)}$'s, which suggests that his occupational noise exposure was more severe than his non-occupational exposure. However, his highest $L_{eq(24)}$, 87.9 dB, was not work-connected. Instead, it occurred on a Saturday, during which time he was intermittently working on a jig-saw. On that particular day, his $L_{eq(day)}$ was 91.5 dB and his $L_{eq(night)}$ was 83.7 dB, both of which exceed those of any other day. Except at 6000 Hz (which were slightly higher than 10 dB), his HTL's were quite close to 0 dB.

[2]The subject numbers used in Tables 4 and 5 correspond to the numbers used in Appendix A.

Subject 39 -- is a 12 year old girl. She played soccer two evenings during the test. And, in the afternoons she practiced gymnastics at school. These activities seem consistent with the fact that her $L_{eq(day)}$'s were generally considerably higher than her $L_{eq(night)}$'s. Over the audiometric frequencies considered, her HTL's averaged about 5 dB.

Subject 2 -- is a 47 year old male factory/commerical worker, who works in a sheet metal shop. His daytime noise exposure during the test week was somewhat more severe than was his night time exposure, as reflected by his median day and night L_{eq}'s. His HTL's at .5, 1, 2, and 3 KHz were fairly consistently at about 10-15 dB, while those at 4 and 6 KHz were about 25 dB.

Subject 24 -- who was classified as a homemaker, is a 24 year old, unemployed male. He reported that he often listened to loud music during the daytime, which is supported by the fact that his $L_{eq(day)}$'s, except on Friday, were considerably higher than his $L_{eq(night)}$'s occurred during evenings (Thursday, Friday, and Sunday) that he spent in a bar.

Noise Exposure by Activity: As mentioned previously, those participants provided with self-reading dosimeters (B&K, Computer Engineering) were requested to take additional dosimeter readings (i.e., in addition to the 8 A.M. and 5 P.M. readings) when they were engaged in particularly noisy activities, and to indicate what these activities were on their noise exposure recording sheets. Of the 35 participants that were provided with self-reading dosimeters, 12 participants kept records that were sufficiently detailed that specific activities could be associated with their own equivalent continuous sound levels (L_{eq}'s). The specific activity data for these 12 participants are summarized in Table 5.

Table 5 shows certain activities were associated with vastly disproportionate amounts of the sound energy. For instance, while working with a jig-saw constituted only 6.5% of subject 5's total exposure time, that one activity produced 52.4% of his total exposure (i.e., 52.4% of the total sound energy to which he was

TABLE 5

SUMMARY OF NOISE EXPOSURE BY IDENTIFIABLE ACTIVITY[2]

	Time (hrs)	% Total Time	% Total Exposure	Average Sound Level (dB)
Subject 5				
In car	8	4.8	6.0	83.6
Jig-Saw	11	6.5	52.4	91.6
All Other	149	88.7	41.6	79.3
	168	100.0	100.0	82.6
Subject 9				
To bank	2	1.2	0.7	70.1
Loafing	6.5	3.9	6.3	74.5
Cooking	0.3	0.2	0.3	75.3
Watching TV	5	3.0	2.0	70.7
Entertaining	5	3.0	3.6	73.2
Laundermat	5	3.0	7.8	76.6
Cleaning Carpet	3.5	2.1	1.4	70.6
All Other	140.7	83.6	77.9	72.1
	168	100.0	100.0	72.4
Subject 14				
In car	3	1.8	11.3	86.0
All Other	165	98.2	88.7	77.6
	168	100.0	100.0	78.0
Subject 16				
In car	3	1.8	5.0	76.9
Cooking	2	1.2	2.9	76.3
All Other	163	97.0	92.1	72.2
	168	100.0	100.0	72.4
Subject 17				
Dressing	0.5	0.3	7.1	72.1
Proof reading	2	1.2	0.3	62.2
Typing	6	3.6	7.1	71.3
Watching TV	2	1.2	0.8	66.7
Bowling	6	3.6	35.7	78.3
All Other	151.5	90.1	49.0	65.7
	168	100.0	100.0	68.3
Subject 20				
Watching TV	10	6.0	4.3	73.8
Movie	2	1.2	2.1	77.6
Rock Concert	4	2.4	75.3	90.2
All Other	152	90.4	18.3	68.3
	168	100.0	100.0	75.2

TABLE 5 (Continued)

	Time (hrs)	% Total Time	% Total Exposure	Average Sound Level (dB)
Subject 22				
Bowling	11	6.5	36.8	79.5
Pinball	3	1.8	10.0	79.5
TV/Music	3	1.8	1.5	71.1
Bowling/Pinball	6	3.6	20.1	79.5
All Other	145	86.3	31.6	67.6
	168	100.0	100.0	72.0
Subject 23				
Working on Car	30.5	18.2	20.4	77.5
In car	3	1.8	1.7	76.9
All Other	134.5	80.0	77.9	76.9
	168	100.0	100.0	77.0
Subject 26				
Housework	25	14.9	13.3	71.0
Playing Cards	4	2.4	3.7	73.4
All Other	139	82.7	83.0	71.5
	168	100.0	100.0	71.5
Subject 29				
In car	5.5	3.3	20.8	78.3
Conversation	1.5	0.9	4.2	77.0
All Other	161	95.8	75.0	69.2
	168	100.0	100.0	74.2
Subject 36				
Party	4	2.4	5.0	72.2
All Other	164	97.6	95.0	68.9
	168	100.0	100.0	69.0
Subject 43				
Walking	1	0.6	0.3	70.7
Raking	8	4.8	4.1	73.0
Shopping	3	1.8	6.9	79.5
Studying	16	9.5	1.0	63.7
Church	3	1.8	8.4	85.1
All Other	137	81.5	79.3	73.4
	168	100.0	100.0	73.6

exposed over the course of the 7-day test). Even more striking, one 4-hour rock concert, while constituting only 2.4% of subject 20's total exposure time, produced 75.3% of her total exposure.

The identifiable activities that produced the five highest average sound levels included the two just mentioned (working with a jig-saw, 91.6 dB; attending a rock concert, 90.2 dB), riding in an automobile (86.0 and 83.6 dB), and attending church (85.1 dB).

Riding in an automobile was an activity for three additional participants, for whom it was associated with average sound levels of 78.3, 76.9, and 76.9 dB. While watching television, average sound levels were 73.8, 70.7, and 66.7 dB. Cooking was associated with average sound levels of 75.3 and 76.3 dB, while bowling was associated with sound levels of 78.3 and 79.5 dB.

B. SUBJECTIVE RATINGS

Distribution of Responses: Each of the 50 subjects made ratings (see rating scales in Appendix C) on 9 subjective variables. The distributions of responses to these items, plus comments when appropriate, are shown below:

1. In comparison to others, how often do you feel you are exposed to loud noises?

% Responses	Response Category
8	great deal less
26	little less
40	about the same
24	little more
2	great deal more

2. How would you rate the amount of loud noise you are exposed to at work (or school) compared to the amount you are exposed to at home or away from work?

% Responses	Response Category
4	great deal less at work
20	less at work
30	about equal
26	more at work
20	great deal more at work

3. When you listen to music, at what level do you prefer the volume to be?

% Responses	Response Category
2	very low
12	low
58	medium
22	high
6	very high

4. If you had to rate your hobbies and recreational activities on a scale of loudness, how would you rate them?

% Responses	Response Category
2	extremely quiet
28	quiet
58	medium
10	loud
2	extremely loud

5. If you had to rate your favorite hobby on a scale of loudness, how would you rate it?

% Responses	Response Category
4	extremely quiet
38	quiet
42	medium
12	loud
4	extremely loud

6. Do you think the amount of noise you are exposed to daily is anyway damaging to your hearing?

% Responses	Response Category
38	no
28	probably not
20	do not know
14	probably yes
0	yes, definitely

Although 14% of the subjects thought that their normal exposure was probably damaging, a fairly large percentage indicated that they had no basis for knowing. The majority of the subjects, however, thought that their normal noise exposure was either not damaging to their hearing or probably not damaging.

7. With the exception of when you were sleeping, about how often did you wear the dosimeter?

% Responses	Response Category
0	almost never
0	25% of the time
4	half of the time
32	75% of the time
64	almost all the time

During waking hours, the subject was instructed to remove the dosimeter and place it nearby whenever engaged in particularly strenuous activities or in other activities that precluded wearing a dosimeter. From their responses to this item, it appears that the subjects did wear their dosimeters during a substantial portion of their waking hours. One of the two subjects that reported having worn their dosimeters "about half of the time" indicated that, at times, she had placed her dosimeter nearby when she was sitting at a desk. Although "sitting at a desk" does not preclude wearing a dosimeter, the microphone was in close proximity to her. Consequently, this probably did not adversely influence her dosimeter readings.

8. How inconvenient did you find it to wear the dosimeter?

% Responses	Response Category
24	very
54	slightly
22	not at all

Seventy-six percent of the participants reported that wearing a dosimeter had been either slightly or not at all inconvenient. Only 24% reported that it had been very inconvenient. While these responses to wearing a dosimeter were not particularly unfavorable, they would probably have appeared more favorable if this item had been worded to emphasize "convenient" rather than emphasizing "inconvenient."

9. In comparison to the amount of noise you feel you are usually exposed to in a week, the noise you were exposed to this past week was:

% Responses	Response Category
2	much less than usual
14	less than usual
72	about the same
12	more than usual
0	much more than usual

Subjective Ratings x Occupation: After the subjective ratings were made, the subject's responses were converted into numerical values from 1 to 5, where the first response category was assigned a value of "1" and the last category, a value of "5" (or, in the case of the eighth subjective variable, a "3"). Then, for each subjective variable, a one-way analysis of variance was performed in which occupation was treated as the independent variable. These analyses are summarized in Table 6.

TABLE 6

SUBJECTIVE RATINGS x OCCUPATION: SUMMARY OF ANALYSES

Subjective Variable:	Factory/ Commercial	Office	Home maker	Pre-College	College
Relative Exposure*	3.7	2.5	2.4	2.8	2.9
Relative Work Exposure*	4.4	3.1	2.6	3.4	3.4
Preferred Music Volume	2.9	3.2	3.3	3.2	3.3
Hobby/Recreational Loudness	2.8	2.8	2.7	3.0	2.8
Favorite Hobby Loudness	2.7	2.6	2.9	2.7	2.8
Hazardousness of Exposure	2.0	2.1	1.7	2.2	2.5
Amount Dosimeter Worn	4.8	4.6	4.6	4.4	4.4
Dosimeter Inconvenience	3.0	3.2	3.2	2.8	2.6
Noise During Test Week	2.7	3.1	2.8	3.0	3.1

*Statistically significant, $p < .05$.

From inspection of Table 6, it can be seen that significant differences ($p < .05$) were detected as a function of occupation on two of the subjective variables: the relative exposure variable (variable 1) and the relative work exposure variable (variable 2).

Considering the response categories for variable 1, it is clear that, on the average, the factory/commercial workers thought themselves exposed to loud noises more often than those in the other occupational groups. Considering the mean ratings on Variable 2, it is apparent that the factory/commercial workers felt themselves to be exposed to more loud noise at work than did those in the other occupational groups.

C. AUDIOMETRY

Hearing Threshold Level: Combined HTL's at 6 audiometric frequencies are summarized in Table 7 for those 48 participants who took the audiometric tests.

TABLE 7

SUMMARY OF HEARING THRESHOLD LEVELS

Frequency (KHz)	Mean	SD	Range	50^{th} %ile	90^{th} %ile
.5	6.0	6.2	-9 to 17	5.5	13.5
1	3.0	7.0	-9 to 22	2.5	13.0
2	1.9	7.9	-9 to 23	0.2	11.7
3	2.6	6.7	-9 to 15	2.5	13.4
4	5.4	8.5	-10 to 27	5.4	13.8
6	11.9	11.3	-7 to 60	10.4	23.9

Occupation and HTL: Combined HTLs at .5, 1, 2, 3, 4 and 6 KHz were analyzed by separate one-way analyses of variance in which occupation was treated as the independent variable. These analyses are summarized in Table 8.

It can be seen that significant differences ($p < .05$) in HTL were detected among occupations at each audiometric frequency except .5 and 2 KHz. At 3, 4, and 6 KHz, factory/commercial workers had the highest HTL's, but only slightly higher than office workers. Whether or not the higher HTL's among factory/commercial and office workers may be partially due to past occupational noise exposure is not known. Then too, HTL's are also greatly influenced by variables such as age, time on the job, past military/recreational noise exposure, and etc. As would be expected, for example, significant correlations ($p < .05$) were found between age and HTL at each audiometric frequency (r = 0.32; 0.47; 0.51; 0.58; 0.61; and 0.45).

TABLE 8

COMPARISONS OF HTL'S AMONG OCCUPATIONS

		Hearing Threshold Level (in dB), Mean					
		Frequency (KHz)					
Occupation	Mean Age	.5	1*	2*	3*	4*	6*
Factory/ Commerical	34.4	6.8	4.6	5.7	6.5	10.7	19.6
Office	28.9	8.0	6.3	3.7	5.4	9.2	16.1
Homemaker	26.2	6.7	4.8	3.0	1.9	5.7	7.8
Pre-college[2]	12.4	5.7	1.0	-0.5	-0.1	0.5	3.3
College[3]	21.1	2.3	-2.6	-3.2	-1.1	0.3	7.9

*Statistically Significant, $p < .05$.
[2]Excludes one 5 year old.
[3]Excludes one 21 year old.

Thus the higher HTL's observed among factory/commercial and office workers were undoubtedly partially due to their ages, which on the average were higher than those associated with the other groups.

D. PREDICTING L_{eq}'s and HTL's

The individual's perception of his noise exposure might be predictive of his overall $L_{eq(24)}$ and, perhaps, of his HTL's. Therefore, correlations were calculated between certain subjective variables (relative noise exposure, preferred music volume, hobby/recreation loudness, favorite hobby loudness, and hazardousness of normal noise exposure), average $L_{eq(24)}$ and the HTL's. However, none of these correlations was significant ($p < .05$), suggesting that the individual's perception of his noise exposure is not a good indicator of his typical daily noise exposure or of his hearing threshold.

Since the individual's typical noise exposure might also be predictive of his HTL's, correlations were calculated between average $L_{eq(24)}$ and each of the audiometric variables, however, they too were not significant ($p < .05$).

E. DOSIMETER CONSISTENCY

It is clear that the dosimetery data collected in this study would be of little value if there was no assurance that the various dosimeters utilized produced similar readings for a particular noise exposure and that a given dosimeter did not introduce a systematic bias into the readings. In order to assure ourselves that the dosimeter data were reasonably reliable, several validation checks were conducted in addition to the standard calibration checks described earlier. These validation checks were accomplished both prior to and subsequent to the 7-day tests.

Validation Test 1: Six dosimeters were placed at equal distances around a radio that was playing popular music for 6 minutes. The results of this test are summarized below:

Dosimeter	Accumulated Counts: Calibration: 68.3 sec @ 94 dB	Accumulated Counts: Actual	L_{eq} in dB
Loomis #34	550	1787	81.9
Loomis #35	555	1577	81.3
Computer Engineering #1	1017	3217	81.8
Computer Engineering #2	376	1195	81.8
B&K #1 (30 dB pre-amp)	326	925	81.3
B&K #2 (30 dB pre-amp)	408	968	80.5

It can be seen that the responses of these dosimeters were quite similar. In fact, the differences between the highest and lowest L_{eq}'s was only 1.4 dB.

Validation Test 2: Two B&K dosimeters were used to assess consistency both between units of the same type and with regard to microphone placement. B&K #1 was worn with the microphone approximately 15 cm above the waist. B&K #2 was worn with the microphone on the shoulder at ear level. Noise exposure included about 1.5 hours in a car on the highway with the window down, 4 hours around radio and television at medium volume, and 0.5 hour around a tractor. The total exposure time was 16 hours.

Dosimeter	Accumulated Counts: Calibration: 68.3 sec @ 94 dB	Accumulated Counts: Actual	L_{eq} in dB
B&K #1 (30 dB pre-amp)	326	855	68.9
B&K #2 (30 dB pre-amp)	408	952	68.4

Here, not only were the L_{eq}'s from two different dosimeters quite similar, but they were quite similar even though the microphones were not in close proximity. This suggests that microphone placement is probably not as critical as some writers have suggested.

Validation Test 3: An individual wore 3 dosimeters simultaneously for 24 hours, 32 minutes. The results are summarized below:

Dosimeter	Accumulated Counts: Calibration: 68.3 sec @ 94 dB	Accumulated Counts: Actual	L_{eq} in dB
Loomis #34	550	8511	74.8
Computer Engineering #2	376	4724	73.9
B&K #2 (16 dB pre-amp)	13.8	269	75.8

Again, the L_{eq}'s are quite similar. These three validation tests, as well as others that were conducted during the course of this project, demonstrate that none of the dosimeters used in this study appear to have a systematic bias. Although on a given occasion a particular dosimeter might indicate a higher or lower L_{eq} than was actually the case, there is no evidence to suggest that it may have done so in any consistent fashion -- such as consistently reading high or low.

SECTION 4

DISCUSSION

According to the Environmental Protection Agency's levels document (EPA, 1974), restricting daily $L_{eq(24)}$'s to 73 dB would protect virtually the entire population from any significant hearing impairment (i.e., from any permanent threshold shift in excess of 5 dB).[3] Consequently, a daily exposure that does not exceed an $L_{eq(24)}$ of 70 dB can be considered a "safe exposure for protection of hearing that has an adequate margin of safety."

In the present investigation, the noise exposure of 50 subjects was continuously monitored for 7 consecutive days. Over these days, mean daily $L_{eq(24)}$'s were 72.8, 74.1, 72.8, 73.4, 74.1, 73.8, and 71.4 dB, while the corresponding median daily $L_{eq(24)}$'s were 72.8, 74.3, 73.2, 74.1, 74.5, 73.6, and 71.1 dB. The similarity between the means and medians reflects the fact that the L_{eq}'s were fairly normally distributed and, thus, that each measure can interchangeably be used to represent the typical subject's $L_{eq(24)}$. Clearly, then, on each day of the test, the typical subject had daily $L_{eq(24)}$'s that exceeded what, to the Environmental Protection Agency, constitutes a safe exposure. In fact, over 80 percent of the subjects had 7-day energy average $L_{eq(24)}$'s that exceeded 70 dB, while the mean and median 7-day energy average $L_{eq(24)}$'s were 74.5 and 74.7 dB.

If $L_{eq(24)}$'s differed greatly from day to day within subjects, there would be large discrepancies between the individual's mean and energy average $L_{eq(24)}$'s. For example, suppose an individual's daily $L_{eq(24)}$'s were 60, 60, 60, 60, 90, 90, and 90 dB. His mean $L_{eq(24)}$ would then be 72.9 dB, while his energy average $L_{eq(24)}$

[3] It should be emphasized that the 70 dB level, as published in the document, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety", was identified without considering technical or economic feasibility.

would be 86.3 dB. Since such discrepancies would express themselves as large differences between the overall mean $L_{eq(24)}$ and the mean 7-day energy average $L_{eq(24)}$, it might be questionable as to which measure better represented the typical subject's daily $L_{eq(24)}$. In this investigation that question is moot since the overall mean $L_{eq(24)}$ and the mean 7-day energy average $L_{eq}(24)$ were very similar (73.3 vs. 74.5 dB).

The mean 7-day energy average $L_{eq(24)}$ observed in this investigation is probably a somewhat conservative estimate of the typical individual's normal exposure since individuals from noise intensive industry may have been under-represented in the sample of subjects selected. Thus, the typical individual, over the course of a normal week, probably has a 7-day energy average $L_{eq(24)}$ somewhat in excess of 75 dB. Since the typical individual's $L_{eq(24)}$'s are probably several decibels higher than the 70 dB limitation suggested in EPA's levels document, does this mean that most of us are at risk of some significant, noise-induced, hearing impairment? It may, but again it may not. In establishing the 70 dB limitation, the EPA was attempting to protect the individual with an adequate margin of safety. Quite simply, this means that an $L_{eq(24)}$ of 70 dB is a conservative estimate of what is necessary to protect the public from any significant hearing impairment.

The EPA's levels document also suggested that restricting occupational noise exposure to an $L_{eq(8)}$ of 75 dB would be sufficient to protect the public since this would still result in an $L_{eq(24)}$ of about 70 dB -- provided that non-occupational exposure was negligible. For most of us, though, non-occupational exposure is probably not negligible. In fact, among the participants in this investigation, $L_{eq(night)}$'s (non-occupational) averaged just 1.7 dB less than $L_{eq(day)}$'s.

Even though 7-day energy average $L_{eq(24)}$'s for most subjects exceeded what EPA considers a safe exposure level, their L_{eq}'s were much lower than that which would be experienced by a worker who during the work week was exposed to the maximum level permissible under OSHA's current noise exposure regulation. At the very minimum, such a worker would have a 7-day energy average $L_{eq(24)}$ of about 84 dB. Only one subject's 7-day energy average was that high and, surprisingly enough, he was a 13 year old boy. But he was not the only youngster with high L_{eq}'s. Those in the pre-college group exhibited higher 7-day energy average $L_{eq(24)}$'s than did those in any other occupational group. Ranging from 69 to 84.9 dB, only one of the pre-college subjects' energy average $L_{eq(24)}$'s fell below 70 dB.

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APPENDIX A

L_{eq}'s and Combined Hearing Threshold Levels (HTL), Arranged by Subject*

*The overall L_{eq}'s represent energy average L_{eq}'s. Thus, for instance, overall $L_{eq(24)}$ is, in fact, an $L_{eq(week)}$.

SUBJECT 1 MALE 54 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	77.5	75.7	77.2	77.7	73.7	70.6	67.5	75.5
LEQ(DAY)	79.6	78.4	78.9	80.9	76.8	68.8	68.3	77.8
LEQ(NIGHT)	75.3	72.4	76.2	72.1	68.6	71.4	70.0	73.0

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	13.5	13.0	22.0	14.5	10.5	23.0

SUBJECT 2 MALE 47 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	78.2	83.7	80.9	73.9	79.2	76.3	79.3	80.1
LEQ(DAY)	80.8	86.7	83.8	80.9	82.1	77.6	81.6	82.7
LEQ(NIGHT)	79.2	75.3	77.2	78.4	75.4	75.4	76.9	77.5

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	13.0	12.0	23.0	15.5	27.0	24.5

SUBJECT 3 MALE 33 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	72.1	72.1	73.8	73.5	71.4	66.8	67.0	71.6
LEQ(DAY)	74.1	74.1	75.8	76.0	74.1	68.1	68.1	73.8
LEQ(NIGHT)	68.4	70.3	72.0	70.5	68.6	65.9	67.2	69.4

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	11.5	5.5	-5.0	-4.0	24.5	1.5

SUBJECT 4 MALE 31 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	75.2	78.3	81.3	75.8	70.2	73.5	73.7	76.7
LEQ(DAY)	74.7	77.5	84.3	79.4	74.6	72.6	74.7	75.7
LEQ(NIGHT)	75.5	73.7	77.4	69.7	65.0	73.8	73.1	75.0

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-1.0	5.0	0.0	0.0	12.5	60.0

SUBJECT 5 MALE 27 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	80.9	82.1	82.3	80.2	79.2	87.9	71.6	82.6
LEQ(DAY)	83.8	89.2	85.5	83.5	82.7	91.5	72.5	86.0
LEQ(NIGHT)	76.9	79.7	78.1	75.7	65.0	83.7	75.4	78.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-1.0	.5	-4.5	0.0	-.5	12.5

SUBJECT 6 FEMALE 45 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	72.0	73.0	71.6	73.5	70.3	68.3	70.4	71.6
LEQ(DAY)	73.9	74.0	75.5	76.7	70.7	70.7	74.5	74.2
LEQ(NIGHT)	70.2	72.2	62.0	69.0	71.1	65.5	58.7	68.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	7.5	2.5	8.0	13.0	9.5	14.0

SUBJECT 7 FEMALE 20 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	66.5	68.1	70.1	77.6	77.9	73.3	69.1	73.8
LEQ(DAY)	69.1	71.1	69.1	71.2	74.7	67.8	73.2	71.5
LEQ(NIGHT)	63.8	63.7	70.5	79.2	79.4	74.4	66.9	74.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	9.0	-1.0	-1.5	6.0	2.0	8.5

SUBJECT 8 FEMALE 21 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	68.4	70.9	66.6	69.1	68.9	62.5	64.4	68.0
LEQ(DAY)	67.4	72.2	71.3	71.1	71.6	65.1	66.3	70.0
LEQ(NIGHT)	58.9	69.8	50.0	66.5	66.4	60.3	62.4	66.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.0	4.0	14.0	7.0	6.0	16.0

SUBJECT 9 FEMALE 17 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	73.4	72.0	71.4	74.2	71.9	70.9	72.3	72.4
LEQ(DAY)	70.6	71.9	63.1	65.2	63.1	72.0	74.1	70.4
LEQ(NIGHT)	74.5	72.6	73.2	76.1	73.8	70.2	70.9	73.4

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-2.0	-3.5	-7.0	2.5	3.5	10.0

SUBJECT 10 FEMALE 44 YEARS OLD OCCUPATION: FACTORY

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	76.4	74.4	75.4	77.1	77.8	78.7	77.4	75.9
LEQ(DAY)	78.6	79.7	77.6	77.3	80.4	82.2	79.7	79.1
LEQ(NIGHT)	74.3	74.7	74.9	77.5	75.3	75.4	76.3	75.6

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	12.0	3.0	7.5	10.5	11.5	25.5

SUBJECT 11 MALE 35 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	77.2	75.5	74.0	75.2	74.8	74.5	74.0	75.2
LEQ(DAY)	78.6	74.0	74.0	74.0	74.0	77.8	74.0	75.7
LEQ(NIGHT)	76.1	76.0	74.0	76.9	76.2	74.0	74.0	75.5

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	9.5	8.0	-1.0	1.5	6.5	21.5

SUBJECT 12 MALE 25 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	77.5	77.5	77.1	79.6	77.1	77.7	76.9	77.7
LEQ(DAY)	78.6	78.2	78.4	81.5	77.8	78.6	77.6	78.9
LEQ(NIGHT)	76.5	77.1	76.1	77.8	76.7	77.0	76.3	75.8

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	10.0	5.0	-.5	.5	-1.5	10.0

SUBJECT 13 MALE 33 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	70.7	65.9	61.8	65.2	64.8	65.7	60.8	66.1
LEQ(DAY)	64.5	67.3	63.0	66.0	68.1	69.3	63.4	66.5
LEQ(NIGHT)	72.3	64.9	60.8	64.8	60.2	59.8	57.6	65.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	3.0	-5.0	-.5	3.5	8.5	25.0

SUBJECT 14 MALE 35 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	78.2	76.4	75.6	76.6	78.6	78.1	80.6	78.0
LEQ(DAY)	76.6	71.5	77.4	69.8	75.1	79.8	81.7	77.6
LEQ(NIGHT)	79.1	75.3	75.1	77.9	79.8	76.6	79.6	78.0

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	9.0	4.0	3.0	11.5	27.0	27.0

SUBJECT 15 MALE 24 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	76.0	76.7	74.0	74.5	76.2	74.9	69.8	75.0
LEQ(DAY)	77.0	77.3	71.5	71.4	73.4	76.8	71.3	74.9
LEQ(NIGHT)	75.0	76.2	75.1	75.6	77.1	73.6	69.1	75.1

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.5	6.5	2.5	2.5	-.5	6.5

SUBJECT 16 FEMALE 49 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	71.4	71.5	73.3	71.3	69.0	74.6	73.2	72.4
LEQ(DAY)	73.4	73.4	66.6	73.4	70.6	75.1	76.0	73.4
LEQ(NIGHT)	69.4	69.7	75.0	69.3	67.6	74.0	69.9	71.5

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.5	14.0	8.0	14.0	12.0	12.5

SUBJECT 17 FEMALE 24 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	64.4	66.7	73.3	67.9	66.5	68.5	61.5	68.3
LEQ(DAY)	66.5	67.0	70.4	70.5	69.6	71.2	62.3	69.0
LEQ(NIGHT)	62.4	66.5	74.4	65.0	62.2	65.3	61.0	67.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL (DB)	5.0	0.0	5.0	5.5	10.5	11.0

SUBJECT 18 FEMALE 22 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	75.1	76.8	75.2	75.6	78.5	76.9	77.6	76.7
LEQ(DAY)	74.0	74.7	75.9	75.2	74.8	79.9	73.9	76.7
LEQ(NIGHT)	76.0	77.7	74.7	75.9	79.7	74.0	74.7	76.5

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL (DB)	13.5	7.5	9.0	5.5	11.5	14.5

SUBJECT 19 FEMALE 20 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	70.3	67.8	67.2	66.8	65.0	71.0	72.7	69.4
LEQ(DAY)	69.5	69.7	70.9	68.9	64.8	73.7	63.6	69.3
LEQ(NIGHT)	70.8	65.9	60.4	64.6	65.7	67.8	73.9	68.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL (DB)	3.5	9.5	7.5	5.0	7.5	13.5

SUBJECT 20 FEMALE 22 YEARS OLD OCCUPATION: OFFICE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	70.2	82.8	66.5	64.0	68.6	68.0	70.8	75.2
LEQ(DAY)	72.5	73.7	70.5	57.0	71.5	69.3	66.1	70.6
LEQ(NIGHT)	66.1	84.6	64.5	65.1	66.3	67.4	71.4	76.6

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL (DB)	15.5	13.5	3.5	4.0	10.5	19.0

SUBJECT 21 MALE 35 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	67.9	71.2	66.9	68.8	73.4	69.0	67.2	69.3
LEQ(DAY)	71.2	74.1	67.8	71.6	73.5	71.0	70.7	71.3
LEQ(NIGHT)	65.0	67.8	66.4	65.3	73.2	67.1	65.0	68.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	6.0	3.0	.5	8.0	15.0	2.0

SUBJECT 22 MALE 25 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	70.9	71.5	75.2	65.9	66.6	72.7	73.5	72.0
LEQ(DAY)	64.5	66.3	73.9	68.1	68.0	70.7	66.1	71.3
LEQ(NIGHT)	72.6	73.4	76.9	63.5	65.4	62.9	75.6	72.8

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	12.0	7.5	4.5	-1.0	-2.0	7.0

SUBJECT 23 MALE 24 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	76.0	73.6	79.4	75.8	76.5	77.3	77.9	77.0
LEQ(DAY)	77.9	77.3	81.9	77.5	73.3	79.6	78.3	78.6
LEQ(NIGHT)	74.3	70.0	75.4	74.3	77.7	78.7	77.7	76.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.5	3.0	-.5	8.0	10.5	17.5

SUBJECT 24 MALE 24 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	79.3	78.6	77.4	82.0	79.4	76.3	81.3	79.6
LEQ(DAY)	83.6	82.3	80.5	83.6	75.9	79.9	84.0	82.1
LEQ(NIGHT)	74.0	74.0	74.0	80.7	80.7	74.0	78.1	77.5

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	1.5	-.5	-1.5	-7.0	0.0	3.0

SUBJECT 25 MALE 24 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	38.4	79.7	65.6	74.6	68.9	71.3	67.5	80.7
LEQ(DAY)	92.2	81.2	65.0	77.2	67.1	70.5	65.0	84.3
LEQ(NIGHT)	32.3	76.3	66.3	73.1	70.4	72.9	69.8	76.0

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	5000 HZ
COMBINED HTL(DB)	2.5	-1.0	-5.0	-6.0	-5.0	10.5

SUBJECT 26 FEMALE 19 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	70.9	69.9	68.7	68.7	75.4	71.3	71.0	71.5
LEQ(DAY)	73.1	73.3	65.0	70.1	68.4	70.3	73.6	71.3
LEQ(NIGHT)	68.7	69.5	71.2	67.7	77.1	73.4	68.2	72.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	12.5	12.5	5.5	3.0	8.5	15.5

SUBJECT 27 FEMALE 25 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	78.2	80.2	69.7	73.7	74.0	75.9	66.9	75.9
LEQ(DAY)	78.3	74.0	70.0	76.2	74.0	77.9	74.0	75.6
LEQ(NIGHT)	77.9	81.9	73.7	74.5	74.0	74.3	68.8	75.7

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-4.5	-2.5	-2.5	-7.5	-2.5	-4.5

SUBJECT 28 FEMALE 27 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	63.0	62.8	63.8	64.9	73.0	74.0	59.2	69.0
LEQ(DAY)	66.5	62.0	66.8	67.9	76.2	77.0	61.0	71.9
LEQ(NIGHT)	58.6	62.8	60.1	60.7	68.5	70.2	57.7	65.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	6.3	5.0	10.0	5.5	2.5	9.0

SUBJECT 29 FEMALE 33 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	71.7	79.3	73.3	71.3	69.0	74.9	68.6	74.2
LEQ(DAY)	71.7	81.4	75.3	71.7	70.6	75.6	71.1	75.7
LEQ(NIGHT)	73.6	76.7	71.1	71.1	69.0	74.0	68.2	72.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	17.0	22.5	21.5	14.0	17.0	16.5

SUBJECT 30 FEMALE 25 YEARS OLD OCCUPATION: HOMEMAKER

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	65.0	79.9	70.4	65.0	71.4	76.0	65.2	73.4
LEQ(DAY)	65.0	81.8	72.6	67.3	73.7	74.0	71.7	75.4
LEQ(NIGHT)	65.0	76.0	69.5	65.9	70.1	76.4	66.2	72.1

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.0	-2.0	-2.5	1.5	13.0	1.0

SUBJECT 31 MALE 9 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	67.2	69.6	68.3	73.8	68.9	72.1	70.0	70.6
LEQ(DAY)	69.8	71.5	71.6	75.7	73.0	75.5	72.3	73.2
LEQ(NIGHT)	64.8	67.9	65.7	71.9	58.5	65.6	67.2	67.3

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	3.0	-4.5	-9.0	-4.5	-6.5	.5

SUBJECT 32 MALE 16 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	75.5	74.9	74.9	74.3	76.0	78.1	76.5	75.9
LEQ(DAY)	75.4	75.9	77.8	74.0	78.8	80.0	76.8	77.4
LEQ(NIGHT)	75.6	74.1	74.0	74.9	74.0	76.4	76.3	75.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	6.5	.5	-6.5	1.5	-.5	1.5

SUBJECT 33 MALE 9 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	74.0	74.0	77.5	76.5	75.9	79.3	77.4	76.7
LEQ(DAY)	75.4	74.0	78.5	74.3	76.3	80.3	78.9	77.4
LEQ(NIGHT)	74.0	74.0	76.8	77.4	75.7	78.5	76.3	76.4
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		2.5	-6.5	-6.5	-1.0	-5.0	-.5	

SUBJECT 34 MALE 15 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	66.4	71.4	72.9	69.1	72.9	73.1	63.3	71.0
LEQ(DAY)	69.0	74.6	68.7	71.1	76.2	76.3	67.6	73.2
LEQ(NIGHT)	63.4	66.6	74.3	67.1	68.3	72.5	59.5	69.6
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		13.5	15.0	2.5	2.5	1.5	6.5	

SUBJECT 35 MALE 13 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	83.1	84.4	84.9	85.1	86.6	84.3	85.2	84.9
LEQ(DAY)	85.6	84.1	86.7	87.6	85.6	86.7	86.5	86.2
LEQ(NIGHT)	80.2	84.7	83.3	82.5	87.1	81.7	84.1	83.9
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		-4.0	-6.5	-7.5	-8.0	-9.0	-4.0	

SUBJECT 36 FEMALE 16 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	64.1	68.6	71.5	68.8	67.6	70.6	68.7	69.0
LEQ(DAY)	66.5	71.5	73.3	72.5	65.2	70.8	69.7	70.7
LEQ(NIGHT)	61.8	64.8	69.8	61.7	68.5	70.4	68.5	67.7
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		15.0	9.0	12.0	7.5	11.0	8.0	

SUBJECT 37 FEMALE 3 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	77.8	75.1	77.5	76.3	79.0	75.5	79.5	77.5
LEQ(DAY)	78.6	77.1	75.6	77.7	81.0	78.3	82.1	79.1
LEQ(NIGHT)	77.3	74.0	78.4	75.2	77.1	74.0	76.4	76.3

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-8.0	-5.5	-5.5	-4.0	-.5	6.0

SUBJECT 38 FEMALE 5 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	73.4	80.1	78.6	80.5	75.5	70.9	63.7	77.1
LEQ(DAY)	62.8	80.5	78.1	81.3	79.5	74.7	60.8	77.9
LEQ(NIGHT)	75.9	79.0	79.1	79.9	62.4	64.6	64.9	75.4

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	99.0	99.0	99.0	99.0	99.0	99.0

SUBJECT 39 FEMALE 12 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	76.9	85.6	81.9	82.6	80.6	79.9	73.5	81.5
LEQ(DAY)	79.1	88.4	84.8	86.2	83.3	83.5	67.4	84.4
LEQ(NIGHT)	79.1	81.5	78.2	61.8	78.1	74.0	75.2	77.7

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	9.0	2.0	11.5	.5	5.5	.5

SUBJECT 40 FEMALE 14 YEARS OLD OCCUPATION: PRECOLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	76.1	78.6	71.5	69.9	83.4	72.6	63.1	77.3
LEQ(DAY)	78.1	80.7	75.6	71.3	81.1	79.6	63.7	78.1
LEQ(NIGHT)	74.7	76.0	59.4	68.7	84.2	74.3	62.7	77.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	14.0	5.5	4.5	5.0	8.0	11.5

SUBJECT 41 MALE 21 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	66.4	68.5	72.3	76.6	73.0	75.7	71.1	73.1
LEQ(DAY)	68.7	70.6	72.8	76.7	72.8	74.6	71.4	73.2
LEQ(NIGHT)	54.2	66.5	71.9	76.7	73.1	76.2	70.9	73.1

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	99.0	99.0	99.0	99.0	99.0	99.0

SUBJECT 42 MALE 19 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	71.7	71.4	69.6	71.9	74.4	71.7	72.0	72.0
LEQ(DAY)	73.8	68.9	71.3	70.6	70.5	74.1	70.8	71.8
LEQ(NIGHT)	70.0	72.4	68.2	72.3	75.6	69.2	72.5	72.1

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	-1.0	-8.0	-3.0	-5.5	-4.0	-.5

SUBJECT 43 MALE 24 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	68.8	67.6	68.8	65.0	76.3	73.4	79.5	73.6
LEQ(DAY)	72.8	68.1	65.0	65.0	69.9	76.9	77.3	73.1
LEQ(NIGHT)	65.0	67.2	70.4	65.0	78.0	67.2	79.1	73.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	13.0	-2.0	.5	4.5	9.0	19.0

SUBJECT 44 MALE 21 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	66.6	68.2	71.6	71.3	75.3	80.2	71.1	74.3
LEQ(DAY)	68.9	69.9	72.7	73.9	78.2	72.4	70.3	73.4
LEQ(NIGHT)	65.0	66.7	70.8	68.7	71.6	81.9	71.5	74.8

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	5.0	-5.5	-6.5	-2.5	-.5	14.5

SUBJECT 45 MALE 22 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	66.5	71.2	65.0	76.6	74.4	70.5	65.0	71.9
LEQ(DAY)	67.7	71.6	66.4	73.1	72.9	70.1	65.0	70.5
LEQ(NIGHT)	65.5	70.9	65.0	77.9	75.0	70.8	65.0	72.6
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		-1.5	-4.5	-3.5	-4.0	-4.0	0.0	

SUBJECT 46 FEMALE 21 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	62.1	63.6	63.8	64.5	76.6	65.4	68.2	69.7
LEQ(DAY)	65.0	66.8	59.9	66.1	68.5	69.2	67.7	66.9
LEQ(NIGHT)	58.3	58.9	65.2	63.1	78.4	57.2	68.4	70.7
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		5.0	1.5	-3.5	1.5	1.0	17.5	

SUBJECT 47 FEMALE 21 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	65.0	71.7	66.5	72.3	69.5	70.5	70.2	70.0
LEQ(DAY)	65.0	74.6	70.2	75.0	72.4	72.3	73.4	72.7
LEQ(NIGHT)	65.0	68.5	65.9	69.5	66.0	69.9	70.4	68.3
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		5.0	0.0	-2.5	-2.0	-1.0	7.5	

SUBJECT 48 FEMALE 19 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	75.4	74.4	73.7	72.1	71.9	77.1	78.5	75.3
LEQ(DAY)	73.8	76.8	75.0	76.1	77.5	81.0	77.2	77.3
LEQ(NIGHT)	74.8	70.1	77.6	65.0	76.5	75.7	73.8	74.7
		500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ	
COMBINED HTL(DB)		-8.5	-9.0	-9.5	-9.5	-10.0	-6.5	

SUBJECT 49 FEMALE 22 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	83.2	75.9	74.5	78.0	77.1	74.0	74.0	78.0
LEQ(DAY)	79.0	73.7	78.3	79.6	77.9	74.5	74.0	77.9
LEQ(NIGHT)	84.6	74.0	74.5	74.0	75.5	74.0	74.0	78.2

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	1.5	5.0	3.5	15.0	5.5	22.0

SUBJECT 50 FEMALE 21 YEARS OLD OCCUPATION: COLLEGE

LEQ(DBA):	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY	SUNDAY	OVERALL
LEQ(24)	78.1	76.0	76.0	80.1	79.5	76.6	74.0	77.6
LEQ(DAY)	74.0	75.4	76.1	81.5	75.9	78.9	76.2	77.6
LEQ(NIGHT)	79.3	76.6	76.0	78.9	80.4	77.0	74.0	77.9

	500 HZ	1000 HZ	2000 HZ	3000 HZ	4000 HZ	6000 HZ
COMBINED HTL(DB)	2.5	-1.0	1.0	-7.0	1.5	-2.5

APPENDIX B

Distribution of 350 L_{eq}'s

DISTRIBUTION OF 350 L_{eq}'s

L_{eq}	FREQUENCY 24-Hour	Day	Night
50			1
51			-
52			-
53			-
54			-
55			-
56			-
57		1	1
58		-	3
59	1	-	5
60	-	1	6
61	1	2	3
62	3	2	8
63	5	5	5
64	8	2	4
65	13	15	26
66	6	7	15
67	17	12	14
68	14	14	11
69	20	13	17
70	16	15	23
71	29	29	14
72	24	19	11
73	18	22	12
74	28	32	39
75	20	21	25
76	27	22	31
77	24	19	23
78	21	23	18
79	20	16	13
80	9	11	6
81	7	12	2
82	4	10	5
83	5	2	2
84	3	9	3
85	3	2	3
86	1	4	-
87	2	4	1
88		2	
89		-	
90		-	
91		-	
92		2	

APPENDIX C

Rating Scales

PRE-TEST SCALES

1. In comparison to others, how often do you feel you are exposed to loud noises (include music, social events, hobbies, etc.)?

   a. I am exposed to a great deal less than others
   b. I am exposed to a little less than others
   c. I am exposed to about the same amount as others
   d. I am exposed to a little more than others
   e. I am exposed to a great deal more than others

2. How would you rate the amount of loud noise you are exposed to at work (or school) compared to the amount you are exposed to at home or away from work?

   a. I am exposed to a great deal less at work than elsewhere
   b. I am exposed to less at work than elsewhere
   c. The levels are about equal
   d. I am exposed to more at work than elsewhere
   e. I am exposed to a great deal more at work than elsewhere

3. When you listen to music, at what level do you most prefer the volume to be?

   a. Very low
   b. Low
   c. Medium
   d. High
   e. Very high

4. If you had to rate your hobbies and recreational activities on a scale of loudness, how would you rate them?

   a. Extremely quiet
   b. Quiet
   c. Medium
   d. Loud
   e. Extremely loud

5. If you had to rate your <u>favorite</u> hobby on a scale of loudness, how would you rate it?

   a. Extremely quiet
   b. Quiet
   c. Medium
   d. Loud
   e. Extremely loud

6. Do you think the amount of noise you are exposed to daily is in any way damaging to your hearing?

   a. No
   b. Probably not
   c. Do not know
   d. Probably, yes
   e. Yes, definitely

POST-TEST SCALES

7. With the exception of when you were sleeping, about how often did you wear the dosimeter?

   a. Almost never
   b. About 25% of the time
   c. About half of the time
   d. About 75% of the time
   e. Almost all the time

8. How inconvenient did you find it to wear the dosimeter?

   a. Very inconvenient
   b. Slightly inconvenient
   c. Not inconvenient at all

9. In comparison to the amount of noise you feel you are usually exposed to in a week, the noise you were exposed to this past week was:

   a. Much less than usual
   b. Less than usual
   c. About the same
   d. More than usual
   e. Much more than usual

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