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I. SUMMARY

On June 2, 1988, the International Association of Fire Fighters' (IAFF) Department of Health and Safety requested the National Institute for Occupational Safety and Health (NIOSH) to conduct a Health Hazard Evaluation (HHE) on behalf of their Local #1 in Pittsburgh, Pennsylvania. The request was to evaluate the noise exposure levels found in the activities of the Pittsburgh Bureau of Fire (PBF) and to assess the amount of hearing loss among current fire fighters in the department.

Noise dosimeter surveys were conducted at 18 of the 36 total fire stations during the weeks of September 12, and October 3, 1988. The Bureau's fire apparatus assigned to the 36 fire stations in Pittsburgh were driven in simulated emergency runs July 17-19, 1990, in order to tape record the noise levels emitted by the vehicles for later one-third octave band spectral analysis. The third phase of the evaluation, audiometric testing, was completed on 424 PBF fire fighters from January 9-20, 1989.

The noise surveys revealed that the 8-hour time-weighted average (TWA) noise exposures were generally less than the amount allowed under any of the environmental evaluation criteria used by NIOSH. However, portions of the noise analyses found noise levels that greatly exceeded the exposure limits for brief periods of time. These high exposures were usually associated with emergency response runs in the fire vehicles.

The statistical tests performed on the audiometric data showed a statistically significant relationship between the time spent with the PBF and the amount of hearing loss in fire fighters after the effects of age had been corrected from the hearing levels. The effects on hearing were seen in the audiometric test frequencies most sensitive to noise insult, as well as in the frequencies used in human speech perception.

Based on the results of the audiometric data analyses, as well as the potential for high level noise exposures in the PBF, the NIOSH investigator concludes that a health hazard exists for fire fighters in the PBF. A statistically significant relationship was found between the amount of hearing loss and the time spent in the department after the data were corrected for age using correction factors published in the Occupational Safety and Health Administration's noise regulation. Section IX of this health hazard evaluation report offers recommendations to the PBF which can reduce the noise exposures to the fire fighters and help prevent further hearing losses.

KEYWORDS: SIC 9224 (Fire departments, including volunteer), noise exposure, noise dosimetry, fire apparatus noise, hearing loss, hearing conservation.

II. INTRODUCTION

On June 2, 1988, the International Association of Fire Fighters' (IAFF) Department of Health and Safety requested the National Institute for Occupational Safety and Health (NIOSH) to conduct a Health Hazard Evaluation (HHE) on behalf of their Local #1 in Pittsburgh, Pennsylvania. The request was to evaluate noise exposure and hearing loss among fire fighters at the Pittsburgh Bureau of Fire (PBF). On August 17, 1988, an opening conference was held at the Bureau's headquarters in Pittsburgh where the Bureau expressed an interest in the project and stated that a cooperative effort with the local union should be undertaken.

A three-phased approach to investigate the noise levels and the hearing levels found in the PBF was agreed on by all parties during the opening conference; (1) noise dosimetry on the daywatch shifts at half of the fire stations staffed by the PBF; (2) spectral measurements of the noise from vehicles used by the PBF; and (3) audiometric evaluations of approximately half of the Bureau's fire suppression manpower. The results from each phase were provided to union and management officials through letters and interim reports. The results of the noise dosimetry at the fire stations was provided in an interim report dated November 14, 1988. Individual fire fighters were provided the results of their hearing tests by letter on February 10, 1989, and summary results of the audiometric examinations were provided to union and management officials on February 17, 1989. Finally, the vehicle noise levels were reported by letter on August 14, 1990. This final report presents a summary of the previously reported results and a more thorough analysis of the data than that provided in the earlier reports.

III. BACKGROUND

The PBF is responsible for providing fire suppression and prevention services along with "first responder" emergency medical services to the 56 square miles of city and 370,000 people of Pittsburgh, Pennsylvania. Thirty-six fire stations located throughout the city house the Bureau's fleet of fire apparatus and 960 fire fighters. The stations are staffed 24 hours per day, seven days per week by fire fighters working either a daywatch or nightwatch shift. The 960 fire fighters are divided into four groups, or lines, to cover the stations at all times.

IV. MATERIALS AND METHODS

A. Dosimetry

Noise dosimeter surveys were conducted during the weeks of September 12, and October 3, 1988. During the two weeks, a total of 18 fire stations were surveyed on two consecutive days for 8 hours each day during the daywatch shift. During the survey days, a NIOSH industrial hygienist was at a surveyed station during the entire 8-hour sampling period. The hygienist was issued turnout gear by the PBF and rode the vehicles whenever they left the station in one of the extra jumpseat positions on the vehicle. A detailed time log was kept by the hygienist so that the time of the responses could be calculated and also any noisy events could be noted. The stations were selected so that representative vehicles used by the PBF were included in the stations sampled. Whenever possible, the busiest stations in the city (based on 1987 run records) were chosen to maximize the likelihood that the vehicles would be called out for response to emergency situations.

Members of the crew assigned to a vehicle were asked to wear a noise dosimeter for 8 hours of their work shift. If they were required to put on their turnout gear for an emergency response, the fire fighters were reminded to place the microphone of the dosimeter outside of the turnout gear, exposing it to the noise environment. The noise dosimeters used in this phase were Metrosonic Model dB301/26 Metrologgers, a small noise level recording device worn on the waist of the fire fighter with a 1/4 inch remote microphone placed on the shirt collar of the station uniform. This dosimeter measures noise in decibels, A-weighted levels (dB[A]) four times per second. The measurements are integrated according to the Occupational Safety and Health Administration (OSHA) noise regulation (see Evaluation Criteria section of this report) for an entire minute and stored separately in the Metrologger for data storage and later analysis. Generally, five or six dosimeters were placed on the fire fighters assigned to the surveyed station house.

Each dosimeter was calibrated according to the manufacturer's instructions before being placed on a fire fighter. After the shift was completed, the dosimeter was removed from the fire fighter and placed in the standby mode of operation. Once the data had been transferred to a computer for storage, the dosimeter was again calibrated to assure the electronics of the device had not changed during the sampling period. The data from each Metrologger dosimeter was transferred to a Metrosonics Model dt-390 Metroreader/Data Collector following the day's noise sampling. The information was then transferred to a NEC Laptop Computer with a Metrosonics' Metrosoft software package for permanent data storage and later analysis.

B. Vehicle Spectrum Measurements

The Bureau's fire apparatus assigned to each of the 36 fire stations during the July 17-19, 1990, testing period were brought either to an undeveloped area along the riverfront or to Three Rivers Stadium for data collection. The data collection consisted of tape recording the sounds from the vehicle; such as engine noise, sirens, and air horns; from the riding positions of the vehicles with a Panasonic Model SV-250 Digital Audio Tape (DAT) Recorder. Additional data were collected with a Larson-Davis Model 800B Integrating Sound Level Meter at each riding position. The data from the sound level meter were recorded on data sheets. The tape recordings were later analyzed with a GenRad Model 1995 Integrating Real-Time Analyzer to produce intensity by frequency (spectral) graphs which describe the predominate sounds on the vehicles.

Recordings were obtained over a 30-60 second period when lights, sirens, and air horns (if available) were operating with the vehicle driven on the streets simulating an emergency run for the fire apparatus. Measurements of engine noise without warning devices operating were also stored on the DAT recorder while the vehicle was driven. The vehicles were driven at speeds of 35-50 miles per hour during the recording period. Noise measurements were made in each of the riding positions of the apparatus; normally, the cab and tailboard or jumpseat for an engine; the cab and jumpseat and tiller, where appropriate, for the trucks; and the front and back seats of squad and battalion chief cars.

C. Audiometric Testing

The audiometric tests were administered by a Council for Accreditation in Occupational Hearing Conservation (CAOHC) certified occupational hearing conservationist. Testing was conducted in the basement of a centrally located fire station where an Acoustic Systems Model RE-60 Transportable Sound Booth was assembled to isolate the fire fighter during the testing procedure and keep the ambient noise levels to a minimum. Audiometric testing was done with a Tracor Model RA400 Microprocessor Audiometer, which also allowed for the electronic storage of the audiometric results. The audiometric data were downloaded daily to a NEC laptop computer for permanent storage and later analysis.

Engine and truck companies reported to the test site every 45 minutes for audiometric testing. Informed consent was obtained from each fire fighter prior to testing. Additionally, a short, self-administered work history questionnaire (Appendix 1) was completed by the participants prior to taking the audiometric examination. Following a brief set of instructions about the hearing test procedure, pure-tone audiometric thresholds were obtained from the fire fighters at 500, 1000, 2000, 3000, 4000, 6000, and 8000 Hertz (Hz) separately for each ear, beginning with the left ear. Total test time was approximately 10 minutes per person. The audiometer was given an exhaustive calibration by a manufacturer's representative laboratory immediately prior to this HHE. Daily biological calibrations were made with a Tracor Oscar II electro-acoustic ear. The results of the audiometric examination were briefly reviewed with each fire fighter by the Project Officer immediately following the test.

V. EVALUATION CRITERIA

A. Noise

Noise-induced loss of hearing is an irreversible, sensorineural condition that progresses with exposure. Although hearing ability declines with age (presbycusis) in all populations, exposure to noise produces hearing loss greater than that resulting from the natural aging process. This noise-induced loss is caused by damage to nerve cells of the inner ear (cochlea) and, unlike some conductive hearing disorders, cannot be treated medically.[1] While loss of hearing may result from a single exposure to a very brief impulse noise or explosion, such traumatic losses are rare. In most cases, noise-induced hearing loss is insidious. Typically, it begins to develop at 4000 or 6000 Hz (the hearing range is 20 Hz to 20000 Hz) and spreads to lower and higher frequencies. Often, material impairment has occurred before the condition is clearly recognized. Such impairment is usually severe enough to permanently affect a person's ability to hear and understand speech under everyday conditions. Although the primary frequencies of human speech range from 200 Hz to 2000 Hz, research has shown that the consonant sounds, which enable people to distinguish words such as "fish" from "fist," have still higher frequency components.[2]

The A-weighted decibel (dBA) is the preferred unit for measuring sound levels to assess worker noise exposures. The decibel unit is dimensionless, and represents the logarithmic relationship of the measured sound pressure level to an arbitrary reference sound pressure (20 micropascals, the normal threshold of human hearing at a frequency of 1,000 Hz). Decibel units are used because of the very large range of sound pressure levels which are audible to the human ear. The dBA scale is weighted to approximate the sensory response of the human ear to sound frequencies. Because the dBA scale is logarithmic, increases of 3 dBA, 10 dBA, and 20 dBA, represent a doubling, tenfold increase, and 100-fold increase of sound levels, respectively. It should be noted that noise exposures expressed in decibels cannot be averaged by taking the simple arithmetic mean.

The OSHA standard for occupational exposure to noise (29 CFR 1910.95)[3] specifies a maximum Permissible Exposure Limit (PEL) of 90 dB(A)-slow response for a duration of 8-hours per day. The regulation, in calculating the PEL, uses a 5 dB time/intensity trading relationship. This means that in order for a person to be exposed to noise levels of 95 dB(A), the amount of time allowed at this exposure level must be cut in half in order to be within OSHA's PEL. Conversely, a person exposed to 85 dB(A) is allowed twice as much time at this level (16 hours) and is within his daily PEL. Both NIOSH, in its Criteria for a Recommended Standard,[4] and the American Conference of Governmental Industrial Hygienists (ACGIH), in their Threshold Limit Values (TLV®s),[5] propose an exposure limit of 85 dB(A) for 8 hours, 5 dB less than the OSHA standard. Both of these latter two criteria also use a 5 dB time/intensity trading relationship in calculating exposure limits.

TWA noise limits as a function of exposure duration are shown as follows:

	Sound Level dB(A)	
Duration of Exposure (hrs/day)	NIOSH/ACGIH	OSHA
16	80	85
8	85	90
4	90	95
2	95	100
1	100	105
1/2	105	110
1/4	110	115*
1/8	115*	---
		**

* No exposure to continuous or intermittent noise in excess of 115 dB(A).

** Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level.

The OSHA regulation has an additional action level (AL) of 85 dB(A) which stipulates that an employer shall administer a continuing, effective hearing conservation program when the TWA value exceeds the AL. The program must include monitoring, employee notification, observation, an audiometric testing program, hearing protectors, training programs, and recordkeeping requirements. All of these stipulations are included in 29 CFR 1910.95, paragraphs (c) through (o).

The OSHA noise standard also states that when workers are exposed to noise levels in excess of the OSHA PEL of 90 dB(A), feasible engineering or administrative controls shall be implemented to reduce the workers' exposure levels. Also, a continuing, effective hearing conservation program shall be implemented.

B. <u>Audiometry</u>

The audiometric test results obtained for the fire fighters were combined according to two different criteria to determine the degree of hearing handicap that had been sustained. Additionally, a single-frequency, degree of hearing impairment criterion was used to initially screen the data to determine the amount of hearing loss found in this population. The first criterion was proposed by NIOSH in its criteria document for occupational noise exposure.[4] This criterion, which is intended to determine the amount of handicap in speech perception and communication abilities, averages the hearing level in decibels (dB HL re ANSI S3.6-1969)[6] at the pure-tone frequencies of 1000, 2000, and 3000 Hz for both ears. This measurement will be referred to in this report as the "mid-frequency" variable. The criterion incorporates a 25 dB "low fence" value. This means that the dB HL average value must exceed 25 dB before a hearing impairment is said to exist. The percentage of impairment is calculated by multiplying each decibel in excess of 25 dB HL by 1.5%. For example, an average dB HL of 40 for the "mid-frequency" variable would represent a 22.5% hearing impairment.

The second variable used in this report has been proposed by the American Academy of Otolaryngology - Head and Neck Surgery.[7] The criterion combines the pure-tone frequencies of 3000, 4000, and 6000 Hz. This combination will be most sensitive to the sensorineural effects on the ear from noise because of the propensity of these frequencies to deteriorate sooner when exposed to loud noises.[8] For this report, the second criterion will be called the "high-frequency" variable.

Finally, a criterion proposed by Eagles, *et al.*[9] for single-frequency hearing impairment determination also uses a low fence of 25 dB HL. With this criterion, any person who had a hearing level of 26 dB HL or greater at any single frequency was classified as having some degree of hearing loss. The degree of loss could range from "mild" (26-40 dB HL) to "profound" (> 90 dB HL). This criterion differs from the other two criteria in that it looks at single test frequencies rather than average hearing levels across several frequencies.

Additional analyses were conducted on the first two criteria after the data had been adjusted for the effects from normal aging processes (presbycusis). In order to do this, the hearing level data were corrected according to the formula described by NIOSH[4] in its criteria document. The formula uses the presbycusis curves for a male population which have been published in the Department of Labor's noise regulation.[3]

VI. RESULTS

A. Dosimetry

During the two weeks of noise sampling, a total of 18 station houses were surveyed over two consecutive daywatch work shifts in each of the stations. All surveyed houses consisted of an engine company and either a truck company or a squad company. Station #24 consisted of all three types of companies. A total of 170, 8-hour noise dosimeter samples were collected and stored for later analysis.

The dosimeter results for the engine, truck, and squad companies are given in Tables 1, 2, and 3, respectively. Each of these tables give the company number, the date of noise dosimeter testing, and the total number of times when the vehicle left the station house (responses) and how many of these responses were emergency in nature with sirens and/or air horns operating. The noise data are presented as a percentage of a daily noise dose according to OSHA regulations, which stipulates a maximum daily dose of 100%. If a fire fighter receives less than 100% of a dose during his or her work shift, the employee is within current OSHA regulations. If the dose exceeds 100%, then the fire fighter is over-exposed to noise on that particular day according to OSHA regulation. Three shift periods are given in these tables. The 8-hour column represents the period of sampling conducted by NIOSH. The 10-hour and 14-hour columns are linear interpolations of the data for the daywatch (10-hour shift) and nightwatch (14-hour shift) periods used by the PBF. These later two columns represent the amount of dose a fire fighter would accumulate if the 8-hour sampling period were representative of a longer work shift, i.e., the same noise events would occur at the same rate for the longer time periods. Finally, a column labeled "Maximum" is the greatest one minute average dB(A) level recorded for any of the fire fighters assigned to the vehicle on the sampling day. It represents a short term exposure period indicative of siren noise, air horn noise, or equipment testing noise.

Inspection of the dosimeter data reveals that the large majority of the averaged daily noise levels were below 100% of a daily allowable dose. None of the truck companies or squad companies had daily average doses in excess of 100%. There were three instances where an engine company was in excess of 100%. Of these three occurrences, one was recorded at the training academy for drivers' training on the Pierce Tiller truck. The other two were recorded when one of the companies had pump testing in the morning and a fire in the afternoon (Station #11) and the other recorded average was at a station with the highest number of responses recorded during the survey period (Station #33). Generally, the recorded noise levels were less than 50% of the daily allowable dose for all of the vehicles surveyed.

The recorded maximum one-minute periods did, however, reveal that the potential for high levels of noise exposure does exist in the PBF as levels of 105 to 120 dB(A) were consistently found in all three types of companies. It is believed that these higher exposure periods are associated with siren, air horn, or equipment noise. In the example in Figure 1, the two separate periods of high noise exposure levels seen at the 3-hour, 15-minute mark and 6-hour, 30-minute mark are both the result of noise levels recorded during emergency responses.

B. Vehicle Spectrum Measurements

The noise data from the simulated emergency response runs collected with the DAT recorder were initially reviewed to ascertain that the recorded sound levels were clean, i.e., the recordings were free of static or peak clipping. Additionally, it was determined if the sound noticeably increased or decreased during the test period which would indicate the volume control on the recorder may have been accidentally changed. Finally, pre- and post-calibration tones placed on the tape were compared to assure that they were the same value. This cursory review resulted in spectral analyses done for the following PBF vehicles: seven, 1988 Pierce Rear Mount trucks; nine, 1986 Pierce engines; three, 1988 Pierce Tiller trucks; one, 1989 Pierce Lance engine; four, 1978 Brockway engines; ten, 1981-82 Grumman engines; four, 1973-74 Mack engines; four, 1984 Thibault Rear Mount trucks; one, 1977 Seagrave Rear Mount truck; one, 1976 Seagrave Tiller truck; one, 1982 Seagrave Front Mount truck; and seven, squad and battalion chief vehicles, consisting of 1986 Dodge or Chevrolet Suburbans.

The median dB(A) sound levels were calculated from the one-third octave spectral data. These results are shown in Table 5. The data are presented for the different riding positions and warning signal conditions. The median dB(A) values range from 79.8 dB(A) for the tailboard riding position with no warning signals on a Grumman engine to a high value of 113.2 dB(A) in the cab of a Mack engine when the siren and air horn are operating. As expected, the dB(A) values were higher when warning signals were operational. Also, the noise levels were found to be generally higher in vehicles where the jumpseat riding positions were next to the vehicle's engine.

Figures 2-24 plot the median one-third octave band sound levels for each of the vehicle types under the various test conditions. The detailed presentation of the data shows the differences in vehicle noise emissions when the recordings are done in cabs, jumpseats, or tailboard and if the warning devices are operational or not. The noise levels from the Pierce engines (Figures 2-3) show that the engine noise is maximum at the 160 Hz one-third octave band and can reach levels of 110 dB in the jumpseat. The mechanical siren and air horn show the most sound energy in the 500 - 5000 Hz range, with a maximum at 1000 Hz. Similar data were recorded for the Pierce Rear Mount and Tiller trucks (Figures 12-16). The mechanical siren and air horn noise has a maximum level at the 1000 Hz band. The engine noise is one band lower, with the 125 Hz one-third octave band showing the greatest noise energy. Sound levels for the engine noise are also approaching 110 dB for the Pierce trucks. The PBF's foam unit, a Pierce Lance (Figures 4-5), does show a noise reduction for the two riding positions. No median one-third octave band sound level exceeded 100 dB and the majority of the band levels were below 90 dB.

The noise levels for the PBF's other engines, Grumman, Brockway, and Mack, are shown in Figures 6-11. These three types of vehicles are characterized as having a riding position on the tailboard at the back of the pumper instead of a jumpseat next to the vehicle's engine. The tailboard position is quieter as evidenced in the plots for the no warning siren conditions. Two different types of sirens are used on these engines; the Grumman and Mack engines use a mechanical siren while the Brockway engine has an electronic siren mounted on a lightbar over the cab. The Brockway engines also did not have air horns installed. All three of these vehicles do not show a strong influence of engine noise in the spectral plots, but do show warning signal noise in the middle frequencies. The Brockway engines with the electronic sirens do have a narrower range of increased sound levels from the siren as compared to the vehicles with the mechanical sirens and air horns. All three types of engines have median noise levels from siren exposure that exceed 100 dB.

The trucks in the PBF fleet, other than the Pierce models, are fewer in number. With the exception of the Thibault Rear Mount truck, the spectral plots represent only one example of the vehicle type. For the Thibault truck (Figures 17-18), a pattern of engine noise having maximum energy at or near the 125 Hz one-third octave band and warning signal noise from 400 - 4000 Hz is seen. Overall, the noise energy for this model is less than other trucks and engines, with a majority of the one-third octave band levels less than 90 dB. In should be noted that the Thibault trucks were equipped with an electronic siren system that placed the speaker below the front bumper. The loudest vehicle tested in the PBF fleet was a Seagrave Tiller truck, an open cab vehicle with a mechanical siren mounted in the center front of the cab, directly below the windshield. Siren noise in excess of 110 dB was recorded for the one-third octave bands from 800 - 1600 Hz (Figure 20). The noise levels recorded in the department's squad vehicles and battalion chief's cars are shown in Figure 24. The major noise source seen for these types of vehicles is the electronic siren, with a very discernable peak in the middle frequencies.

C. Audiometry

Hearing tests were performed on 424 fire fighters with the PBF who were assigned to the 18 fire stations that had been involved in the noise dosimetry phase of the evaluation. Personnel from all four shifts reported to a central location for audiometric testing during their work shift. All but two fire fighters took part in the audiometric testing.

The PBF fire fighters were predominately male, with only two females included in the 424 tested individuals. They had a mean age of 41 years, ranging from 23 to 64 years of age, and a mean time at their job of 14 years with a range of 1 to 39 years of service. The information provided in the questionnaire revealed that for 56 of the fire fighters, the PBF was their first and only job. With regard to non-occupational sources of noise exposure, approximately 63% of the group did not hunt or use firearms, 71% had not ridden motorcycles, and 96% had not used farm machinery. Chain saws had been used by 57% of the fire fighters and woodworking was a hobby for 33% of them. Seventy-three percent of the group reported no medical problems in the past with their ears, but 35% did report tinnitus ("ringing in the ears") and 29% reported a noticeable change in their hearing over the years.

The fire fighters were categorized into six years-of-fire-service groupings in order to analyze the hearing level data. The categories and the number of individuals in each are as follows: less than six years of service (N=76); 6-10 years of service (N=86); 11-15 years of service (N=114); 16-20 years of service (N=50); 21-25 years of service (N=63); and over 25 years in the fire service (N=35). The audiometric data were initially compared to the single test frequency criterion that labels hearing ability from normal to profound loss.[5] Hearing tests were scored according to the worst hearing level recorded, regardless of the ear or frequency. The comparison is shown in Figure 25. The "normal" category shows a general decline in the percentage of fire fighters who fall into this classification as the number of years in the fire service increases, going from 40% for the less than six years of service group to 0% for anyone with more than 20 years of service. The converse relationship is seen for the "severe" loss category, where less than 10% of fire fighters with less than 10 years of service are included, but more than 40% of them with more than 25 years experience have a severe loss at one or more audiometric test frequencies.

The mean hearing level results for each ear of the 424 tested fire fighters at each test frequency are presented in Figure 26. The hearing pattern for the entire group shows a trend of progressively worse hearing as the audiometric test frequency increases from 2000 Hz to 6000 Hz with a slight improvement at 8000 Hz. The hearing ability for the left ears of the fire fighters is generally poorer than the right ears; however, this difference is small. Because of the small difference, the hearing levels of individuals at each audiometric test frequency were averaged for the left and right ears. Figures 27 and 28 show the hearing levels for the 424 fire fighters when categorized by chronological age and by years of fire service, respectively. The same trends are seen in both figures. Hearing ability progressively gets worse as the fire fighters age or spend more time in the fire service, with the greatest changes occurring at 3000, 4000, 6000, and 8000 Hz. A decline in hearing such as seen in the PBF fire fighters tested is characteristic of a noise-induced permanent threshold shift (NIPTS).[1,8]

A Pearson product-moment correlation coefficient between the fire fighters' ages and the amount of time they had spent in the fire service was calculated as +0.87, a statistically significant positive relationship. Thus, before additional statistical analyses were performed on these data, the age-related hearing loss, or presbycusis, was subtracted from the effects due to time on the job. The correction was done by using the age correction values for males published in the OSHA noise regulation.[3] The corrections attempt to subtract the portion of hearing loss that is likely the result of aging from the audiometric test results, leaving a residual loss that is presumed to be from the effects of noise. The two female fire fighters tested were not included in these last statistical analyses.

In order to complete the statistical analyses, the two combination variables discussed in the Evaluation Section of this report were calculated. The "mid-frequency" variable averaged the hearing levels of 1000, 2000, and 3000 Hz and the "high-frequency" variable averaged 3000, 4000, and 6000 Hz. The single-factor independent variable, the years-of-fire-service, was divided into its six levels and an analysis of variance (ANOVA) was calculated to separately analyze each of the two dependent variables. Statistically significant differences between years-of-fire-service groupings were found for each of the dependent measures. For the high-frequency variable, a statistically significant F ratio of 3.13 ($p < 0.0087$) was calculated. The ANOVA for the mid-frequency variable also resulted in a statistically significant F ratio of 6.87 ($p < 0.0001$). A Sheffé post-hoc trend test of the differences between means for each of the six years-of-fire-service groupings was conducted to see where the significant differences occurred. The groups were labeled as follows: group 1, <= 5 yrs.; group 2, 6-10 yrs.; group 3, 11-15 yrs.; group 4, 16-20 yrs.; group 5, 21-25 yrs.; and group 6, > 25 yrs. For the mid-frequency dependent variable, the two fire service groups representing the fire fighters with the most time on the job were significantly different from the other four fire service groups, with one exception. The exception to this was that fire service group 5 did not differ from group 4, while group 6 did differ from group 4. There were no significant differences between groups 1, 2, 3, and 4. The mean values of the mid-frequency variable for each of the six fire service groups, from group 1 to group 6, were 3.6 dB HL; 2.2 dB HL; 4.3 dB HL; 6.2 dB HL; 7.0 dB HL; and 12.7 dB HL, respectively. For the high-frequency variable, the only significant difference found was between group 6 (> 25 yrs.) and group 2 (6-10 yrs.) on the Sheffé post-hoc trend test. The means for the high-frequency variable were 10.8 dB HL; 7.7 dB HL; 10.2 dB HL; 14.0 dB HL; 14.3 dB HL; and 18.3 dB HL for group 1 to group 6.

VII. DISCUSSION

The 8-hour TWA noise exposures measured at 18 of the fire stations during the daywatch were consistently less than the OSHA PEL for noise. Even when the dose percentages were linearly interpolated to the 10- and 14-hour shifts employed by the PBF, only three of the 74 averaged noise dosimeter readings exceeded the 100% permissible dose levels. One of the three averaged noise exposure readings were associated with training exercises on a new fire vehicle, which would not be classified as a routine occurrence. These survey finding are not unusual. Similar results have been reported in other NIOSH evaluations of fire departments in the U.S.[10,11]

The results from the dosimeter survey and from the spectral analyses of the fire apparatus do, however, show a potential for high levels of noise from the operation of the fire apparatus. The plot of the daily noise exposure (Figure 1) clearly shows that emergency responses are associated with high noise exposures for the fire fighters riding in the vehicle. This finding is confirmed by the spectral analyses conducted on the PBF's vehicles during simulated emergency responses. Median noise levels in excess of 90 dB(A) were common for the various riding positions and warning signal conditions tested on the department's fleet of vehicles. Most of the high readings were the result of the use of sirens and air horns, but a few of the high noise readings were also obtained when no warning devices were in use. The spectral levels reported are integrated measurements over a 30 - 60 second time period when the vehicles were in motion and not peak noise levels measured during the simulated runs. Thus, the potential for even higher peak noise levels exists for the PBF fire fighters. A noise level of 90 dB(A) is used by the National Fire Protection Association (NFPA) in its safety and health standard as the not-to-exceed limit where fire fighters are required to wear hearing protection devices.[12]

The hearing tests on 424 of the PBF fire fighters represent nearly one-half of the department's fire suppression personnel. The audiometric data obtained from this group is indicative of people who have been exposed to excessive noise levels during their lifetime. The characteristic noise notch at 3000, 4000, and 6000 Hz is seen in all of the audiometric data, regardless if it is presented by the age of the fire fighter or by the length of service in the fire department. The high-frequency hearing losses increase with increasing time. The results of the ANOVA statistical tests of the audiometric data show that the average hearing levels of these fire fighters are significantly changed as a function of the time spent on the job as a fire fighter. The progressive loss of hearing over time is seen in both the audiometric frequencies sensitive to noise exposure, as well as the frequencies instrumental in hearing speech. An association between hearing losses and time spent on the job as a fire fighter has also been previously reported.[10,13]

VIII. CONCLUSIONS

The statistical analysis of the audiometric data of the PBF personnel confirms that the fire fighters risk occupational hearing losses as a result of their jobs. The characteristic pattern of a progressive loss of high frequency hearing ability as the fire fighters grow older or spend more time in the fire service is consistent with exposure to hazardous noise levels. The noise survey data add additional evidence to this conclusion by showing that the potential for high levels of noise exist in the department. The daily exposure to these levels of noise results in an average loss of hearing of 18 dB, after accounting for the effects of age, among fire fighters who have spent over 25 years in the department.

IX. RECOMMENDATIONS

The results of the health hazard evaluation reveal that fire fighters in the PBF risk an occupational loss of hearing resulting from their job. Both the audiometric data analyses and the noise survey data are consistent with this conclusion. Although sensori-neural hearing loss is generally irreversible, additional loss of hearing from exposure to excessive noise can be prevented. The following recommendations are offered to help reduce the amount of noise to which the fire fighters are exposed and to set up surveillance programs to track the hearing ability of current and future fire fighters in order to implement changes to reduce the hearing losses associated with their jobs.

1. The PBF should implement a hearing conservation program for their department. At a minimum, the program should follow all of the requirements of OSHA's hearing conservation amendment, including noise monitoring, audiometric testing, hearing protection, training, and recordkeeping.[3] Additional guidelines for an effective hearing conservation program are contained in a NIOSH technical report.[14]

2. Some of the highest noise exposures experienced by the PBF fire fighters were observed during emergency responses. The use of hearing protection devices (HPDs) during this activity will greatly reduce fire fighters' noise exposures. A large number of alternative HPDs are available on the market. Ear plugs and ear muffs, the same types as worn in industry, have been successfully used in fire departments. However, because of the time constraints associated with an emergency response run, it is more practical to use ear muffs because of their relative ease in fitting in a short time period. Communication systems with speakers placed in ear muffs and noise-blanking microphones have been developed to connect with fire department radio systems. The NIOSH investigator has seen these in use in several fire departments, including Sacramento, California, and Phoenix, Arizona, as well as in air ambulance services. Recently, an active noise-controlling ear muff that creates a destructive noise to reduce the wearer's exposure has been introduced in the U.S. and marketed as a way to lower noise in emergency medical service vehicles. This latter device is relatively new and expensive.

3. The audiometric data from the hearing conservation program should be analyzed by methods proposed by an American National Standards Institute (ANSI) working group concerned with audiometric database analyses.[15] The analysis techniques have been evaluated by hearing conservation investigators who have reported success in their use.[16-19] The techniques allow a hearing conservationist to identify groups of employees that may need further help in preventing hearing losses through the analysis of group audiometric data, rather than each individual's hearing tests, which are not as sensitive an indicator of a hearing conservation program problem. Small changes over a short period of time can be investigated in order to ascertain, for example, if different kinds of hearing protection are appropriate or if fire fighters assigned to a particular fire vehicle or fire station are exhibiting hearing losses that are changing more rapidly than other members of the department. The use of these techniques may allow for intervention into the problem quicker than if individual hearing tests are evaluated in a routine doctor/patient relationship and consultation.

4. The mechanical siren in use by the PBF generates the warning signal by rapidly turning a wheel inside of the siren's housing. The circular housing has several slots cut in the perimeter to allow the warning sound to escape. When this type of siren is placed on the left fender or left side of the front bumper of the fire vehicle, much of the sound energy is directed back to the driver's side window. A recently

reported study by the Liberty Mutual Insurance Group describes an engineering control that incorporated a shroud installed on the siren that redirects the sound in a forward direction. The siren was also moved to the center of the front bumper. The report states that a 70% reduction in the sound pressure levels were afforded as a result of the change.[20] The PBF should consider applying this type of engineering control to their mechanical sirens.

5. The spectral data reported for the vehicles in use by the PBF showed that fire fighters riding the Thibault truck had less noise exposure from siren noise than those in the other vehicles which used electronic sirens as the warning device. The speaker for the siren on the Thibault truck was located under the front bumper. Most of the speakers on other fire vehicles, including Brockway engines and squad and battalion chief cars, were mounted on light bars located on the top of the cab. Alternate locations for the speakers on these latter vehicles in the front grille or under the front bumper should be investigated by the vehicle maintenance department.

6. Engine noise was a major source of exposure to the fire fighters during emergency response runs. It was especially evident in vehicles that were configured with the engine located behind the cab and between the jumpseat riding positions. The use of a metalicized blanket over the engine cowling has been observed by the NIOSH investigator in the Anaheim, California Fire Department to reduce the noise that is directed to fire fighters riding in the jumpseats. It also helps to reduce the heat generated by the engine, which was mentioned as a concern by fire fighters during periods of hot weather. This kind of engineering control needs to be investigated with the manufacturers of the vehicles to make sure that heat build-up in the engine does not become a problem. Additional venting of the air around the engine, which will also redirect the noise output, can be pursued by the vehicle maintenance department.

7. The use of noise absorption materials on hard surfaces of the fire vehicles will reduce reverberant noise exposures to the personnel on the vehicles. The older vehicles still used by the PBF can have this kind of material added to the hard surfaces. Newer vehicles may already use this kind of noise control. In either case, a maintenance program that monitors the integrity of the sound absorption materials needs to be implemented. These controls will deteriorate over time in the harsh environments that the fire vehicles encounter. They need to be replaced when they become torn or brittle.

8. Noise controls in vehicles that the manufacturer provides need to be included in future vehicle purchases. Several makers of pumpers and trucks advertise noise control as one of their features. Maximum noise levels for specific operations need to be spelled out in the performance specifications for the purchase of new equipment. The NFPA guidelines are appropriate specifications to which the department can refer manufacturers for maximum noise levels.[12]

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Copies of this report have been sent to:

1. Fire Chief, Pittsburgh Bureau of Fire
2. Local #1, International Association of Fire Fighters
3. Department of Health & Safety, International Association of Fire Fighters
4. OSHA, Region III

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE 1 (Page 1 of 3)

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Engines

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Engine No.	Type	Date	Responses	Maximum	DOSE 8-Hr	DOSE 10-Hr	DOSE 14-Hr
#1	Grumman	9/12	1 (0)	96	17.0 %	21.0 %	29.7 %
		9/13	0 (0)	97	10.3 %	13.0 %	18.0 %
#4	Pierce	9/12	Training	111	79.0 %	99.0 %	138.0 %
		9/13	Training	105	34.0 %	42.7 %	60.3 %
#5	Mack	9/12	4 (3)	102	23.3 %	29.3 %	41.0 %
		9/13	4 (1)	110	24.5 %	30.5 %	43.0 %
#6	Pierce	9/14	2 (1)	116	29.5 %	36.5 %	51.5 %
		9/15	1 (1)	104	19.3 %	24.0 %	33.7 %
#7	Brockway	9/14	0 (0)	115	40.0 %	50.0 %	69.5 %
		9/15	1 (0)	104	24.3 %	30.3 %	42.7 %
#8	Pierce	9/14	4 (4)	109	34.5 %	43.0 %	60.5 %
		9/15	4 (3)	120	51.7 %	64.7 %	90.0 %
#11	Brockway	10/05	4 (3)	110	63.3 %	79.3 %	111.0 %
		10/06	2 (2)	98	13.5 %	17.0 %	23.5 %
#12	Mack	10/03	2 (1)	97	25.5 %	32.0 %	44.5 %
		10/04	0 (0)	108	23.3 %	29.0 %	40.3 %

TABLE 1 (Page 2 of 3)

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Engines

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Engine No.	Type	Date	Responses	Maximum	DOSE 8-Hr	DOSE 10-Hr	DOSE 14-Hr
#13	Mack	10/03	3 (3)	108	20.7 %	25.3 %	35.7 %
		10/04	1 (0)	95	18.7 %	23.3 %	32.7 %
#14	Pierce	10/03	4 (3)	104	24.0 %	30.3 %	42.0 %
		10/04	3 (1)	101	23.0 %	28.7 %	40.7 %
#15	Brockway	10/05	2 (2)	105	16.3 %	20.3 %	28.3 %
		10/06	Training	92	6.7 %	8.3 %	11.7 %
#18	Pierce	10/05	2 (2)	109	24.5 %	30.5 %	43.0 %
		10/06	1 (0)	101	17.5 %	22.0 %	31.0 %
#23	Pierce	9/16	1 (0)	104	35.0 %	43.5 %	61.0 %
		9/17	1 (0)	100	18.0 %	23.0 %	32.0 %
#24	Mack	10/07	2 (2)	108	23.5 %	29.5 %	41.0 %
		10/08	2 (1)	96	24.0 %	30.5 %	42.5 %
#26	Grumman	9/16	1 (0)	98	15.5 %	19.0 %	27.0 %
		9/17	0 (0)	90	9.3 %	12.0 %	16.3 %
#28	Grumman	9/16	4 (2)	95	10.0 %	13.0 %	18.0 %
		9/17	3 (2)	105	25.7 %	32.3 %	45.0 %

TABLE 1 (Page 3 of 3)

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Engines

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Engine No.	Type	Date	Responses	Maximum	DOSE 8-Hr	DOSE 10-Hr	DOSE 14-Hr
#33	Pierce	10/07	7 (6)	111	87.0 %	108.7 %	152.3 %
		10/08	0 (0)	105	37.0 %	46.0 %	64.5 %
#38	Grumman	10/07	0 (0)	95	17.0 %	21.3 %	29.6 %
		10/08	1 (0)	106	16.3 %	20.3 %	28.3 %

Note: Responses represents the number of occurrences where the vehicle left the station. Those which were emergency responses are enclosed in parentheses.

Maximum is the highest one minute average recorded for any one fire fighter assigned to a vehicle.

Dose is the percentage of a daily allowable noise exposure according to OSHA regulation. A dose of 100 % is the maximum allowed for a day. The different hour categories are for the different work schedules of the Pittsburgh Bureau of Fire.

TABLE 2 (Page 1 of 2)

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Trucks

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Truck No.	Type	Date	Responses	Maximum	DOSE 8-Hr	DOSE 10-Hr	DOSE 14-Hr
#1	Pierce	9/12	3 (0)	100	27.5 %	34.5 %	48.0 %
		9/13	3 (0)	99	30.0 %	37.3 %	52.3 %
#4	Pierce	9/12	Training	105	40.5 %	50.5 %	71.0 %
		9/13	Training	104	38.0 %	47.5 %	66.0 %
#5	Seagrave	9/12	3 (2)	108	24.7 %	30.7 %	42.7 %
		9/13	4 (1)	105	22.0 %	27.7 %	38.7 %
#6	Am/LaFrance	9/14	4 (1)	107	19.7 %	24.0 %	34.0 %
		9/15	1 (1)	105	10.7 %	13.3 %	19.3 %
#7	Pierce	9/14	0 (0)	107	39.0 %	49.0 %	68.0 %
		9/15	1 (0)	109	36.0 %	44.5 %	62.5 %
#8	Am/LaFrance	9/14	4 (4)	105	41.0 %	51.0 %	72.0 %
		9/15	1 (1)	101	20.5 %	25.0 %	35.5 %
#13	Am/LaFrance	10/03	0 (0)	100	21.5 %	26.5 %	37.0 %
		10/04	2 (1)	111	33.5 %	41.5 %	58.5 %
#14	Pierce	10/03	3 (3)	100	17.5 %	22.0 %	30.5 %
		10/04	0 (0)	91	10.5 %	12.5 %	18.0 %

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Trucks

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Truck No.	Type	Date	Responses	Maximum	DOSE 8-Hr	10-Hr	14-Hr
#15	Pierce	10/05	2 (1)	104	19.0 %	24.0 %	33.5 %
		10/06	Training	99	9.5 %	12.0 %	17.0 %
#18	Seagrave	10/05	1 (1)	104	23.0 %	29.0 %	40.5 %
		10/06	1 (0)	94	15.5 %	19.5 %	27.5 %
#23	Thibault	9/16	2 (0)	99	38.5 %	47.5 %	67.0 %
		9/17	2 (1)	106	33.7 %	41.7 %	58.3 %
#24	Seagrave	10/07	0 (0)	93	16.0 %	20.0 %	28.0 %
		10/08	1 (0)	103	18.0 %	22.5 %	31.5 %
#26	Thibault	9/16	1 (0)	94	19.0 %	24.5 %	34.0 %
		9/17	0 (0)	86	8.0 %	10.0 %	14.0 %
#38	Thibault	10/07	1 (0)	110	11.0 %	14.0 %	19.5 %
		10/08	1 (0)	94	6.0 %	7.5 %	10.5 %

Note: Responses represents the number of occurrences where the vehicle left the station. Those which were emergency responses are enclosed in parentheses.

Maximum is the highest one minute average recorded for any one fire fighter assigned to a vehicle.

Dose is the percentage of a daily allowable noise exposure according to OSHA regulation. A dose of 100 % is the maximum allowed for a day. The different hour categories are for the different work schedules of the Pittsburgh Bureau of Fire.

TABLE 3

Average Noise Doses, Maximum Levels, and Number of Responses
for the Surveyed Squads

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-290
Sept. & Oct., 1988

Squad No.	Date	Responses	Maximum	DOSE 8-Hr	10-Hr	14-Hr
#11	10/05	4 (4)	101	26.5 %	33.0 %	46.5 %
	10/06	4 (1)	98	18.0 %	22.5 %	31.5 %
#12	10/03	4 (2)	101	17.3 %	21.7 %	30.0 %
	10/04	3 (1)	93	9.0 %	11.0 %	16.0 %
#24	10/07	2 (1)	92	25.0 %	31.0 %	43.0 %
	10/08	1 (0)	92	17.0 %	22.0 %	30.0 %
#28	9/16	0 (0)	88	12.0 %	15.0 %	21.0 %
	9/17	2 (0)	108	20.3 %	25.7 %	35.7 %
#33	10/07	9 (5)	102	42.0 %	52.0 %	73.0 %
	10/08	2 (1)	100	38.5 %	48.0 %	67.0 %

Note: Responses represents the number of occurrences where the vehicle left the station. Those which were emergency responses are enclosed in parentheses.

Maximum is the highest one minute average recorded for any one fire fighter assigned to a vehicle.

Dose is the percentage of a daily allowable noise exposure according to OSHA regulation. A dose of 100 % is the maximum allowed for a day. The different hour categories are for the different work schedules of the Pittsburgh Bureau of Fire.

Median dB(A) Sound Levels for the Fire Apparatus

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-0290

Manufacturer	Vehicle Type	Seat Location	Warning Signals	Median dB(A) Levels
Pierce	Engine	Cab	yes	99.8
	Engine	Cab	no	88.1
	Engine	Jumpseat	yes	104.0
	Engine	Jumpseat	no	100.5
	Rear Mount Truck	Cab	yes	100.0
	Rear Mount Truck	Cab	no	89.6
	Rear Mount Truck	Jumpseat	yes	105.2
	Rear Mount Truck	Jumpseat	no	101.9
	Tiller Truck	Cab	yes	101.8
	Tiller Truck	Cab	no	91.3
	Tiller Truck	Jumpseat	yes	105.9
	Tiller Truck	Jumpseat	no	100.7
	Tiller Truck	Tiller	yes	93.4
	Tiller Truck	Tiller	no	83.4
	Lance (Foam)	Cab	yes	96.2
	Lance (Foam)	Cab	no	89.2
	Lance (Foam)	Jumpseat	yes	89.8
	Lance (Foam)	Jumpseat	no	85.7

TABLE 4 (Page 2 of 3)

Median dB(A) Sound Levels for the Fire Apparatus

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-0290

Manufacturer	Vehicle Type	Seat Location	Warning Signals	Median dB(A) Levels
Seagrave	Rear Mount Truck	Cab	yes	108.2
	Rear Mount Truck	Cab	no	91.1
	Rear Mount Truck	Jumpseat	yes	109.2
	Rear Mount Truck	Jumpseat	no	99.2
	Front Mount Truck	Cab	yes	104.0
	Front Mount Truck	Jumpseat	yes	101.9
	Tiller Truck	Cab	yes	105.9
	Tiller Truck	Cab	no	89.4
	Tiller Truck	Jumpseat	yes	119.4
	Tiller Truck	Jumpseat	no	101.0
Brockway	Engine	Cab	yes	106.1
	Engine	Cab	no	87.9
	Engine	Tailboard	yes	103.4
	Engine	Tailboard	no	82.7
Grumman	Engine	Cab	yes	106.0
	Engine	Cab	no	83.7
	Engine	Tailboard	yes	103.2
	Engine	Tailboard	no	79.8

TABLE 4 (Page 3 of 3)

Median dB(A) Sound Levels for the Fire Apparatus

Pittsburgh Bureau of Fire
Pittsburgh, Pennsylvania
HETA 88-0290

Manufacturer	Vehicle Type	Seat Location	Warning Signals	Median dB(A) Levels
Mack	Engine	Cab	yes	113.2
	Engine	Cab	no	84.4
	Engine	Tailboard	yes	98.9
	Engine	Tailboard	no	85.0
Thibault	Rear Mount Truck	Cab	yes	99.4
	Rear Mount Truck	Cab	no	85.9
	Rear Mount Truck	Jumpseat	yes	102.1
	Rear Mount Truck	Jumpseat	no	93.2
Squads		Front Seat	yes	101.4
		Back Seat	yes	97.8

APPENDIX 1

Voluntary Consent Form and Job History Questionnaire

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL AND PREVENTION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

CONSENT TO PARTICIPATE IN A MEDICAL STUDY

PROJECT TITLE:

HETA #:

PURPOSE:

I, ______________________________, agree to participate in this study.
(Please Print)

The procedures have been discussed with me, and I have been given a copy of this consent form. I understand that:

1. I will be asked questions about work history, noisy activities, and medical symptoms. I will also be given a hearing test which checks my ability to hear different sounding tones.

2. In the unlikely event of physical injury resulting from participation in this study, NIOSH will only be able to provide emergency treatment. Any compensation for medical care or lost wages will have to be obtained under the Federal Tort Claims Act (28 USC 1346 (b)).

3. Except as stated under provisions of the Privacy Act (PL 93-579), no information that I furnish for this study can be disclosed in a manner which will identify me unless I give written permission.

4. My participation is voluntary, and I may withdraw from the study at any time without prejudice to myself.

5. Any questions I have regarding this study should be directed to the project officer, Dr. Randy L. Tubbs, Hazard Evaluations and Technical Assistance Branch, Mail Stop R-11, 4676 Columbia Parkway, Cincinnati, Ohio 45226, telephone (513) 841-4374.

PARTICIPANT'S SIGNATURE ______________________DATE_________

MAILING ADDRESS: ______________________________________
(Please Print) ______________________________________

____

PROJECT OFFICER'S SIGNATURE __________________DATE_________

PITTSBURGH BUREAU OF FIRE
HETA 88-290

FIRE FIGHTER'S SERVICE QUESTIONNAIRE

(leave blank) ID# _______________

1. NAME: ____

2. ADDRESS: ____ (Street)

_________________ _________________ ______________
(City) (State) (Zip)

3. AGE: ________ DATE OF BIRTH: _____ _____ _____
(Years) (Mon) (Day) (Yr)

4. SEX: ________

5. HOW LONG HAVE YOU BEEN A FIRE FIGHTER?: ____________________

CURRENT ASSIGNMENT

6. STATION ASSIGNED: ____________ 7. HOW LONG: ____________

8. JOB CLASSIFICATION: ____

OTHER FIRE DEPARTMENT ASSIGNMENTS (PBF)

9. STATION ASSIGNED: ____________ 10. HOW LONG: ___________

11. JOB CLASSIFICATION: ____

12. STATION ASSIGNED: ____________ 13. HOW LONG: ___________

14. JOB CLASSIFICATION: ____

15. STATION ASSIGNED: ____________ 16. HOW LONG: ___________

17. JOB CLASSIFICATION: ____

Note: If you have had additional assignments, please list on back of this page.

18. COMPANY NAME: ______________________ 19. HOW LONG: ______

20. JOB CLASSIFICATION: ____

21. WHEN DID YOU BEGIN THIS OCCUPATION: ________________________
22. HOURS PER (WEEK) (MONTH) (YEAR): ____________________________

23. COMPANY NAME: ______________________ 24. HOW LONG: ______

25. JOB CLASSIFICATION: ____

26. WHEN DID YOU BEGIN THIS OCCUPATION: ________________________

27. HOURS PER (WEEK) (MONTH) (YEAR): ____________________________

Note: If you have had additional jobs, please list on back of this page.

MILITARY EXPERIENCE

28. YEARS AND MONTHS OF ACTIVE DUTY: _________ __________
(Years) (Months)

29. BRANCH OF SERVICE: ______________ 30. TIME IN COMBAT: ______

31. MILITARY JOBS, ASSIGNMENTS, OR DUTIES:

A. ____
B. ____
C. ____

32. DID YOU FIRE WEAPONS? _____ _____
(YES) (NO)

33. DID YOU FIRE WEAPONS FOR MORE THAN 100 DAYS? _____ _____
(YES) (NO)

HOBBIES AND ACTIVITIES

34. DO YOU ENGAGE IN ANY OF THE FOLLOWING?

	Activity	Yes	No	day	Times per... week	month	year
A.	Hunting	___	___	____	____	_____	____
B.	Shooting	___	___	____	____	_____	____
C.	Motorcycle	___	___	____	____	_____	____
D.	Drag Race	___	___	____	____	_____	____
E.	Chain Saw	___	___	____	____	_____	____
F.	Farm Tractor	___	___	____	____	_____	____
G.	Woodworking	___	___	____	____	_____	____
H.	Loud Music	___	___	____	____	_____	____
I.	Other: ___________	___	___	____	____	_____	____

MEDICAL HISTORY

35. HAVE YOU EVER HAD TROUBLE WITH YOUR EARS? ____ (Yes) ____ (No)

IF YES, DESCRIBE:

____

____

36. HAVE YOU BEEN SEEN BY A PHYSICIAN ABOUT YOUR EARS?

____ (Yes) ____ (No)

37. HAVE YOU EVER NOTICED ANY CHANGES IN YOUR HEARING?

____ (Yes) ____ (No)

38. HAVE YOU EVER HAD ANY OF THE FOLLOWING:

		YES	NO	HEARING CHANGE?
a.	Mumps	___	___	_______
b.	Measles	___	___	_______
c.	Allergies	___	___	_______
d.	High Blood Pressure	___	___	_______
e.	Mycin Drugs (antibiotics)	___	___	_______
f.	Quinine	___	___	_______
g.	Severe Blow to Head	___	___	_______
h.	Tinnitus ("ringing in ears")	___	___	_______
i.	Excessive Ear Wax Buildup	___	___	_______