

NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY III

NHANES III

AUDIOMETRY AND TYMPANOMETRY

FOR

HEALTH TECHNICIANS' MANUAL

Westat, Inc.
1650 Research Boulevard
Rockville, MD

Revised March 1991

TABLE OF CONTENTS

<u>Chapter</u>		<u>Page</u>
1	INTRODUCTION	1-1
1.1	General Overview of Audiometry and Tympanometry Exam Components	1-1
1.1.1	Background on Audition	1-3
1.1.2	Properties of Sound	1-3
1.2	General Overview of Procedures	1-5
1.2.1	Method of Audiometry	1-5
1.2.2	Method of Tympanometry	1-5
2	EQUIPMENT	2-1
2.1	Description of Exam Room in MEC	2-1
2.2	Description of Audiometry Equipment and Supplies	2-1
2.2.1	Inventory of Supplies and Equipment	2-1
2.3	Equipment Setup Procedures	2-2
2.3.1	Start of Stand Procedures	2-2
2.3.2	Calibration Procedures	2-6
2.3.3	Daily Procedures	2-13
2.4	Care and Maintenance of Audiometry Equipment	2-13
2.4.1	Cleaning	2-13
2.4.2	Malfunctions	2-14
2.5	End of Stand Procedures	2-14
2.5.1	Equipment Breakdown	2-14
2.5.2	Packing Supplies and Equipment	2-14
2.6	Description of Tympanometry Equipment and Supplies	2-14
2.6.1	Inventory of Supplies and Equipment	2-14

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
2.7	Equipment Setup Procedures	2-15
2.7.1	Start of Stand Procedures	2-15
2.7.2	Calibration Procedures	2-15
2.7.3	Daily Procedures	2-17
2.8	Care and Maintenance of Tympanometry Equipment	2-17
2.8.1	Cleaning and Maintenance	2-17
2.8.2	Malfunctions	2-19
2.9	End of Stand Procedures	2-19
3	EXAMINATION PROTOCOL	3-1
3.1	Eligibility Criteria	3-1
3.2	Pre-examination Procedures for Audiometric Testing	3-1
3.3	Examination Procedures	3-1
3.3.1	Protocol Procedures for Audiometry	3-1
3.3.2	Protocol Procedures for Tympanometry	3-7
3.3.3	Examination Form for Audiometry and Tympanometry	3-10
4	LOGS AND RECORDS	4-1
4.1	Daily Log	4-1
4.1.1	Hard Copy - Audio and Impedance Daily Log Sheet	4-1
4.1.2	Automated Log Forms	4-3
4.2	Calibration Logs	4-3
4.3	Shipment of Forms and Logs	4-3
5	QUALITY CONTROL	5-1

TABLE OF CONTENTS (continued)

<u>Chapter</u>		<u>Page</u>
6	SAFETY PROCEDURES	6-1
6.1	Equipment Precautions	6-1
6.1.1	Infection Control	6-1
6.2	SP Movement and Positioning	6-1
6.3	Emergency Procedures	6-2

List of Appendices

Appendix

A	Audiometry/Tympanometry Examination Form	A-1
B	Examples of Screening Question Screens	B-1
C	Spanish Version - Examination Form	C-1

List of Exhibits

Exhibit

1-1	The ear	1-4
2-1	Audiometer front panel controls	2-3
2-2	Daily checklist	2-4
2-3	Field calibration form	2-8
2-4	Environmental noise survey form	2-12
2-5	Tympanometer	2-16
2-6	The ear probe	2-18
3-1	Tympanometer front panel	3-8
3-2	Introductory screen	3-11
3-3	Screening question screen	3-12
3-4	Screen question screen	3-13
3-5	Audiometry test screen	3-15
3-6	Audiometry results screen	3-16
3-7	Tympanometry results screen	3-17
3-8	Reasons test incomplete or not done for audiometry and tympanometry	3-18
4-1	Audio and impedance daily log sheet	4-2

1. INTRODUCTION

1.1 General Overview of Audiometry and Tympanometry Exam Components

The hearing component of the NHANES III was developed by NCHS with NIOSH and the National Institute of Neurological and Communicative Disorders and Stroke (NINCDS) and will involve two types of hearing tests. Tympanometry obtains information on the state of the middle ear; air-conduction audiometry measures hearing thresholds. Hearing loss due to noise exposure can be inferred from the pattern of hearing loss in the air-conduction tests.

Information on distributions of hearing levels in the representative NHANES III sample will provide a reference for many of the work environments studied by NIOSH. Data on hearing loss in adults will be used by NIOSH to provide prevalence data of noise-induced hearing loss.

Hearing loss severe enough to interfere with speech is experienced by approximately 8 percent of U.S. adults and 1 percent of children. Hearing loss at this level has consequences for quality of life, development in children, and other problems. Occupational surveys list noise as the first or second most prevalent work hazard worldwide. More than 8 million U.S. workers are exposed to average eight-hour noise levels exceeding 85 dBA, and of this number, 500,000 are estimated by the Occupational Safety and Health Administration (OSHA) to be exposed to 100 dBA or greater. The principal health consequence of excessive noise exposure is permanent hearing loss. The economic consequences of hearing loss are great. Workers' compensation is estimated by the Alliance of American Insurers to average \$80-\$100 million each year, with the number of claims increasing each year.

Data on hearing levels from previous NHANES studies have been used by NCHS to estimate the prevalence of hearing loss by age and other characteristics and NCHS hearing data have been used to demonstrate that hearing levels are associated with employment in occupations with a potential for exposure to noise. With the addition of tests at several new levels, namely 3000, 6000, and 8000 Hz, NHANES III data can be used directly to assess patterns of hearing loss characteristic of noise-induced hearing deficiency.

Audiometry will be conducted on all examinees six to nineteen years of age. Each examinee

will be tested on his/her ability to hear 7 frequencies: 1000 Hz, 2000 Hz, 3000 Hz, 4000 Hz, 6000 Hz and 8000 Hz, 1000 Hz and 500 Hz. At each frequency, the sound in each ear will be tested separately, starting with the right ear if the examinee number is even and the left ear if the examinee number is odd, unless while asking the audiometry questions the technician ascertains that the examinee hears better in one ear than in the other. In that case, the ear in which the examinee hears better will be tested first. By testing the better ear first, the amount of time for testing will be reduced, since if the poorer ear were tested first, that ear would require a repeat test using the masking procedure on the better ear. The masking noise prevents the tones from being heard by the better ear and a false level of hearing being recorded for the poorer ear. The 1000 Hz frequency will be tested twice in order to check on the accuracy and reliability of the examinee's responses.

Tympanometry testing will be conducted on all examinees age six to nineteen. The tympanometer will test the function of the middle ear by first measuring the impedance or flexibility of the eardrums and then by measuring the integrity of the bones in the middle ear. Each ear will be tested separately, randomly starting with the right ear if the examinee number is even and with the left ear if the examinee number is odd.

Although these tests may appear simple, accurate measurement depends on many factors. This section of the manual has been devised to help you understand how to accurately obtain information regarding the sense of hearing and to minimize errors that can occur.

Standardized procedures have been established for this survey. Because the measurements must be obtained in a uniform manner for each subject, it is critical that you always follow these procedures.

You will be trained in the standard procedures and tested on them. During the survey a supervisor will, at times, accompany you in the field to observe the procedures and check the accuracy of the testing procedures. The supervisor will assist you with any problems you have and conduct a brief retraining session. These steps are necessary to assure the completeness and reliability of measurements throughout the survey.

1.1.1 Background on Audition

Audition is the ability to hear. Hearing is the function of the body by which sound is perceived. The ear is the part of the body which enables this function to take place. The ear (Exhibit 1-1) is contained mostly within the temporal bone, which is one of the lateral surfaces of the base of the skull. The ear is subdivided into external, middle and inner ear. Sound waves picked up and directed by the external ear travel to the eardrum (middle ear) and cause it to vibrate. These vibrations move three small bones in the middle ear which set in motion the fluid in the internal ear. This fluid movement stimulates the nerve cells located there and they in turn transmit impulses to the hearing centers of the brain.

1.1.2 Properties of Sound

Sound has three important characteristics: pitch, loudness and quality.

Pitch or tone is that feature of sound which is dependent upon the frequency of the sound waves (frequency being the number of vibrations or cycles of the sound waves per second).

Loudness is that feature of sound which is dependent on the intensity of the sound waves.

Quality is that feature of sound which is dependent upon the higher parts of the sound or overtones. Sounds begin by vibrating as a whole and then rapidly divide into parts which vibrate on their own at their own frequency. Thus, although a sound may have the same frequency and intensity, the quality allows us to distinguish whether it is a zither or a drum.

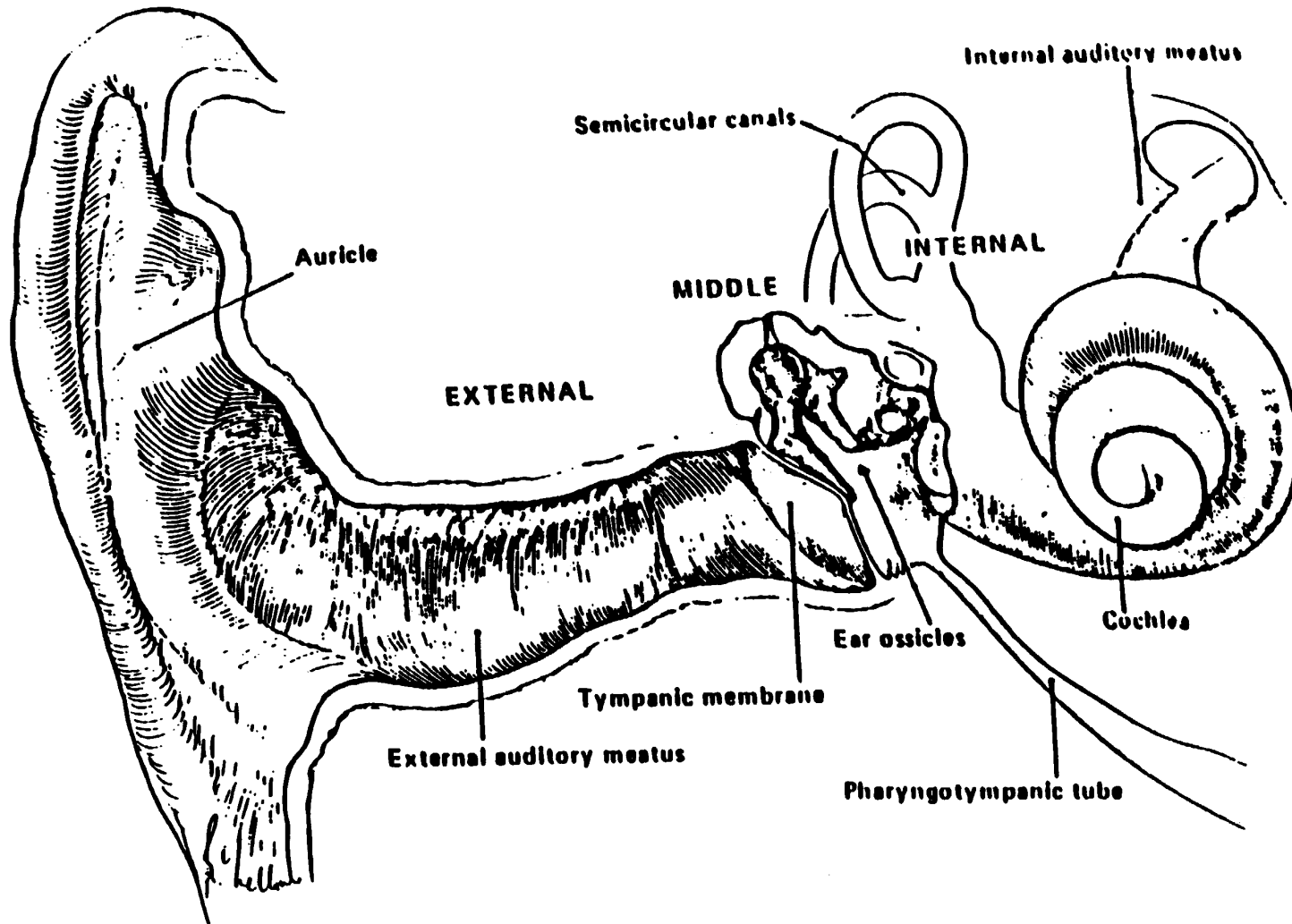


Exhibit I-1. The ear

1.2 General Overview of Procedures

1.2.1 Method of Audiometry

Auditory sensitivity may best be ascertained by the use of an audiometer, which is an electronic oscillator capable of emitting pure tones over a wide range. The examinee is seated in a soundproof room and fitted with a set of earphones to measure his/her threshold (slightest perceptible sound) for pure tone. The hearing loss is measured in decibels (dB's). Various frequencies are selected and the dB's varied until the examinee reports s/he can hear sound. The threshold for each frequency is recorded. The entire range of audible pitches is tested and plotted on an audiogram. The audiogram discloses deviations from normal values in the entire range of audible frequencies. The greater the number of decibels, the greater the hearing loss.

1.2.2 Method of Tympanometry

Tympanometry is a test of the status of the middle ear measured at the level of the eardrum (tympanic membrane). It is a test of the middle ear function only and does not assess hearing ability. The test is conducted by inserting a plastic tip into the ear. There are usually three connections through the plug: a pressure gauge, a pure tone source and a calibrated microphone. A pure tone is sent through the tympanometer and the depth of the tone sent back from the eardrum, recorded by means of the tube connected to the microphone. In this way, the flexibility (impedance) of the eardrum can be calculated. There is a standard range of flexibility of the eardrum which is considered normal. Any disease process that either increases (fluid in the middle ear) or decreases (perforated eardrum) the flexibility of the eardrum interferes with the efficiency with which sound can be transmitted through the middle ear and may be an indication of a hearing loss.

2. EQUIPMENT

2.1 Description of Exam Room in MEC

The audiometry/tympanometry room in the Mobile Examination Center (MEC) is specially equipped to insure that a soundproof environment is achieved for accurate hearing tests. The room has double doors for this purpose. The room setup includes an audiometer, tympanometer, computer terminal and keyboard, and desk area for the technician. The room is arranged so that the examinee is seated adjacent to the technician and therefore cannot observe what the technician is doing or how the equipment is being operated. This is necessary to prevent any cuing to the examinee when he/she is tested on the various frequency levels.

The exam component entitled Central Nervous System (CNS) Testing is also conducted in the audiometry/tympanometry room.

2.2 Description of Audiometry Equipment and Supplies

The equipment supplied for you to obtain the audiograms is listed below:

Grason-Stadler audiometer, Model GSI 16
G&K sound level meter, Model 2235
B&K artificial ear coupler, Model 4151
B&K condenser microphone, Model 4144 (1")
B&K condenser microphone, Model 4155 (½")
B&K octave band filter, Model 1624
B&K acoustic calibrator, Model 4230
B&K Adaptor DB 0375
500-gram weight

2.2.1 Inventory of Supplies and Equipment

An inventory of the audiometry and tympanometry equipment and supplies is conducted at the beginning and the end of each stand. A health technician will be assigned to the room by the MEC manager to do the inventory. Inventory forms will be provided at the time.

2.3 Equipment Setup Procedures

2.3.1 Start of Stand Procedures

Daily Field Checks

1. Preliminary Procedure

- a. Turn the power on and allow the GSI 16 to warm up 10 minutes.
- b. When turned "on", the GSI 16 (Exhibit 2-1) is automatically set to a frequency of 1000 Hz. The following initialization takes place and should be clearly shown on the liquid crystal display (LCD):

<u>Channel 1</u>		<u>Channel 2</u>	
Stimulus:	Tone	Stimulus:	NB Noise
Transducer:	Phone	Transducer:	Phone
Routing:	Right	Routing:	Left
HL:	0 dB	HL:	-10 dB

- c. Turn the "talk back" and "talk forward" controls fully counterclockwise.

2. Tone Quality

- a. Turn Channel 1 "on" by pressing the Channel 1 Interrupt.
- b. Set the Channel 1 HL control at 50 dB.
- c. Alternately switch between the right and left phones using the Channel 1 Routing select button.
- d. Cycle the Test Frequency control successively from 500 Hz through 8000 Hz while listening through each earphone in turn for purity of tone. (If distortion is heard in one earphone, but not in the other, it is probable that the earphones are at fault and should be replaced).
- e. Check the appropriate spaces on the "Daily Field Check" form (Exhibit 2-2) and note any abnormalities.

3. Masking Tone Quality

- a. Deactivate Channel 1, and turn Channel 2 "on" by pressing the Channel 2 Interrupt pushbutton.

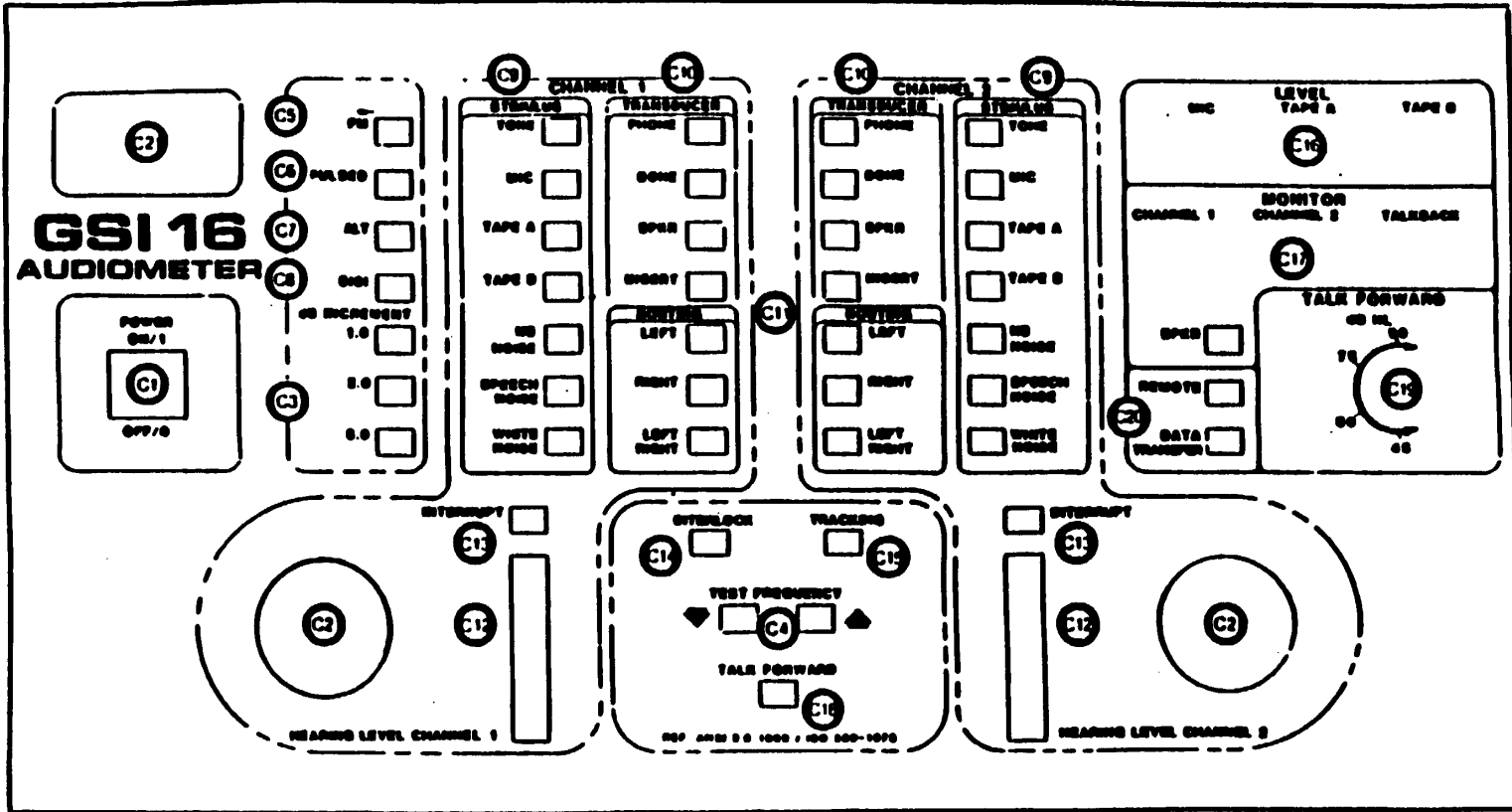


Exhibit 2-1. Audiometer front panel controls

Exhibit 2-2. Daily checklist

NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY III

Daily Checklist for Audiometer Technicians

Audiometer Number _____ Date _____ Stand No. _____

Technician (sign) _____ Location (city) _____

Preliminary Checks		Right Earphone		Left Earphone	
		AM	PM	AM	PM
A. TONAL QUALITY ○ Set HL at 50dB ○ Cycle through all test frequencies: 500, 1000, 2000, 3000, 4000, 6000, 8000	P U R E E (Ch. 1)				
	M A S I N G (Ch. 2)				
B. HEARING LEVEL CONTROL ○ Set Frequency to 2000 Hz ○ Change HL from 0-80 dB and back to 0 dB	P U R E E (Ch. 1)				
	M A S I N G (Ch. 2)				
C. EARPHONE CORD ○ Set Frequency to 1000 Hz ○ Set Channel 1 HL control to 50 dB					

Daily Checklist for Impedance Technicians

Acceptable

Not Acceptable

A. Tympanogram		
B. Reflex		
C. Physical Volume Readout		

- b. Be sure the Channel 2 display still indicates "NB Noise" and the Channel 2 HL control is set at 50 dB.
 - c. Set the Test Frequency control to 500 Hz.
 - d. While listening through each earphone, turn the Channel 2 Routing control alternately from the left to the right earphone.
 - e. Cycle the Test Frequency control successively from 500 Hz to 8000 Hz. Listen for a smooth, even hiss at each frequency.
 - f. Check the appropriate spaces on the "Daily Field Check" form and note any abnormalities found.
4. Hearing Level Control
- a. Select a test frequency of 2000 Hz.
 - b. With the audiometer set for Tone and routed through the right earphone, turn Channel 1 "on."
 - c. While listening through the right earphone, turn the Channel 1 Hearing Level control from 0 to 60 dB HL and back to 0, slow enough to perceive each intensity change. Listen for scratches, abrupt changes in loudness, low frequency hum, or other extraneous signals.
 - d. Repeat this procedure with the Channel 2 Hearing Level control while using "narrow band noise".
 - e. Check the appropriate spaces on the "Daily Field Check" form as each phone is checked and note any abnormal conditions in the "Remarks" section.
5. Earphone Cords
- a. Select a Test Frequency of 1000 Hz.
 - b. Activate the Tone mode for the right phone in Channel 1 and the left phone in Channel 2.
 - c. Set both HL controls to 50 dB.
 - d. While wearing the earphones, flex the cord next to the plug at both ends of each earphone. Listen for an intermittent signal, abrupt changes in signal level, or a scratchy sound that coincides with the flexing of the cord.

- e. If the tone is interrupted or changes loudness, tighten the set screws holding the earphone cord in the earphone. Also, tighten and clean the connector jack at the back of the audiometer with a rubber eraser. Finally, if necessary, replace the cords. If these actions do not correct the fault, replace the audiometer, and notify the biomedical engineer.
 - f. IF it is necessary to replace an earphone cord, notify your supervisor in order for repair or replacement to take place.
6. Internal Controls Check
- a. On occasion, the front panel controls might lock into one state and it is not possible to change any parameter; turn the power off. For example, the words "CAL" or "HELP" may appear in the LCD of either Channel 1 or 2. Wait one minute and then power up again, as it may be a temporary failure. If the condition persists, replace the unit.
 - b. If a portion of the LCD should not light up, be aware that the individual segment of the LCD may be burned out with the functioning of the unit still intact. Replace the unit.
7. Consequences of Field Check Failure

If a unit becomes defective, notify the MEC manager. If neither audiometer works properly, the MEC manager will then contact the engineer at headquarters for further instruction. When a unit is replaced with a back-up, the defective audiometer should be sent for repair and the biomedical engineer notified.

2.3.2 Calibration Procedures

2.3.2.1 Field Calibration

- 1. General
 - a. Do a field calibration of the audiometer at the beginning and the end of each stand. Also calibrate the audiometer in use weekly. The chief technician and/or MEC manager will have the field calibration report forms that give the expected reading at each frequency and the tolerance limits allowed around that reading. The expected readings were determined for each set of field calibration equipment at AML's laboratory. If a microphone requires replacement, the MEC manager will arrange to send the calibration equipment back to AML for a determination of new expected readings for the new microphone. The MEC manager will be in contact with the engineer at headquarters to discuss equipment replacement.

- b. Make reports on the field calibrations form (Exhibit 2-3) in triplicate. Mail one copy that day to the biomedical engineer at headquarters and the other to AML, 3231 Arapahoe Road, Pittsburgh, Pennsylvania 15241. Save the originals until the end of the stand and then send them to the engineer at headquarters.
- c. If the calibration shows a unit to exceed the specified limits, have another technician make an independent calibration. If both technicians agree that the audiometer is in calibration, consider the unit satisfactory for use. If the difficulty cannot be resolved, the MEC manager in conjunction with the engineer at headquarters will arrange to send the defective unit to AML for service.

2. Pure Tone Calibration

- a. Preparation of the sound level meter and octave band filter calibration system
 - (1) Connect the 1624 Octave Band Filter to the 2235 Sound Level Meter (SLM). Squeeze the locks on the sides of the filter and insert the filter connector into the SLM connector. Once the side locks are released, the filter should remain in locked position.
 - (2) Using extreme care because of the fine coupling threads, screw the one-inch Adaptor DB 0375 onto the input stage of the SLM, i.e., the stainless steel tube attached to the top of the SLM.
 - (3) Turn the Power Switch of the SLM to "on." The following reading should be observed in the LCD of the meter for approximately 2 seconds:

B
 A 1 8 8 . 8 |
 T

- (4) If the "BAT" display continues to flash or persists, this is an indication that the batteries are low and should be replaced. Please note that the batteries in both the SLM and the attached filter should be replaced. To install new batteries, slide the battery drawer lock downwards and remove the battery drawer. Four 1.5 volt "AA" Alkaline batteries are required and should be inserted according to the polarity indicated inside the battery drawer. Replace the drawer by pressing firmly until the lock clicks into position. The battery compartments are located on the right hand side of the SLM and filter. Note: The biomedical engineer will normally check the batteries at stand start-up and replace them as necessary. If the technician should have to change batteries, s/he should notify the MEC manager, who will notify the biomedical engineer.

Exhibit 2-3. Field calibration form

National Health and Nutrition Examination Survey III

FIELD CALIBRATION FORM

Masking Noise Calibration

Masking Frequency	Masking Level Setting	Expected Reading "C" slow	Tolerance dB	Actual Reading on Earphone	
				Right	Left
500	60		+5 -3		
1000	60		+5 -3		
2000	60		+5 -3		
3000	60		+5 -3		
4000	60		+5 -3		
6000	60		+5 -3		
8000	60		+5 -3		

Earphone Calibration

Test Frequency	Hearing Level Setting	Ext. Filter Switch Setting	Expected Reading (Ext. Filter)	Tolerance (dB)	Actual Reading	
					Right Phone	Left Phone
500	70	500		+3 -3		
1000	70	1000		+3 -3		
2000	70	2000		+3 -3		
3000	70	4000		+3 -3		
4000	70	4000		+3 -3		
6000	70	8000		+5 -5		
8000	70	8000		+5 -5		

Date _____ Location _____

Calibrator No. _____ Audiometer No. _____ Stand No. _____

- (5) Turn SLM Power Switch to "off."
- (6) Connect the artificial ear coupler to the SLM through the Adaptor with the cable provided. Note: The SLM should be lying face up for this procedure.
- (7) Unscrew the top half of the coupler.
- (8) Remove the plastic cover with desiccant material from the microphone. Then *gently* screw the microphone cartridge (one inch in diameter) with the protective grid onto the bottom half of the coupler. *If binding occurs, please do not continue to force the microphone onto the coupler. [The threads are very delicate and can be easily damaged.] Unscrew the microphone and try again or have someone else do it.*
- (9) Set SLM controls for calibration as follows:

Range:	40-110 dB
Display:	Inst.
Time weighting:	Slow
Pol. Voltage:	200 v
Frequency weighting:	Lin
Sound Incidence:	Frontal
Ext. Filter:	Out
- (10) Now turn SLM back "on."
- (11) Remove the half-inch adaptor from the acoustic calibrator and set the calibrator firmly over the microphone.
- (12) Press the tone actuator (on the side of the calibrator) once and release it. The sound level meter should read 94 dB. If not, use a screw driver (supplied with the meter) to turn the adjustment [Sens. Adj.] screw on the side of the SLM to produce the desired reading. (If the tone has disappeared, reactivate the calibrator.) The sound level meter is now in calibration. [Note: the tone should persist for 30-60 seconds. If the tone lasts for greater than 30 seconds the battery in the calibrator should be replaced.]

b. Mounting of the Earphone

- (1) Screw the top of the coupler back on.
- (2) Set the earphone to be tested over the cavity of the coupler, making sure that the earphone rests squarely on the coupler. Note: Remove the earphone from the headpiece. Pull the clip to the ear set out of the ear phone.

- (3) Place the 500-gram weight on top of the earphone.

c. Calibration Procedures

- (1) Set Ext. Filter setting on SLM to "In." All other settings should remain as before.
- (2) Set the Center Frequency select switch on the filter to 500 Hz.
- (3) Select the earphone to be tested using Channel 1 controls.
- (4) Set the audiometer to a frequency of 500 Hz and a hearing level of 70 dB. The Channel 1 display should indicate the earphone being tested.
- (5) Activate the tone signal with the Channel 1 Interrupt button. Move the earphone and 500 gm weight slightly until a maximum reading is obtained on the SLM.
- (6) Record the sound level meter reading on the report form. The tolerance permitted for the sound level at each frequency is also shown on the Field Calibration form.
- (7) Without touching the coupler, earphone and 500 gm weight, continue testing at the other frequencies indicated on the report form. In each case, the report form provides the expected values for the sound level meter readings and the appropriate settings for the Center Frequency select switch on the filter. [Note: sometimes the expected values are not shown. The MEC manager, chief tech or biomedical engineer will check them for you.]
- (8) To test the other earphone, remove the weight and lift the earphone already tested off the coupler. Place the other phone on the coupler and put the weight back on. Repeat steps (c.) through (g.).

d. Masking Noise Calibration

[Note: The masking noise calibration can be performed on an earphone immediately following the puretone calibration; 1) it saves time, 2) the earphone is already positioned for maximum read-out, 3) you only need to change switch settings on SLM vs dismantling and remounting earphones twice.]

- (1) Set up the field calibration system as before.
- (2) Change the initial setting of the SLM controls as follows:

Frequency Weighting:	C
Ext. Filter:	Out
- (3) Ensure that Channel 1 is deactivated.

- (4) A Test Frequency of 500 Hz should be selected.
- (5) The Channel 2 HL control should be used to select a HL of 60 dB as indicated on the report form provided for narrow band noise masking.
- (6) Select the earphone to be tested; this is the earphone mounted on the coupler.
- (7) Activate the Channel 2 "NB Noise" signal.
- (8) Record the SLM reading on the Field Calibration report form. The Chief Technician will have the expected reading at this frequency and will compare that expected reading with the values obtained. If the SLM reading is within the tolerances shown on the report form, then it is calibrated in this frequency band.
- (9) Repeat this procedure at the other test frequencies indicated on the Field Calibration report form. Again the Chief Technician will have the expected value for each test frequency and will compare that expected value with the values obtained.
- (10) Repeat this procedure for the other earphone (steps 4 through 10).

2.3.2.2 Environmental Noise Survey

1. General

A noise survey is to be done during the setup day before the start of each stand. Send one copy of the completed Environmental Noise Survey form (Exhibit 2-4) immediately to the biomedical engineer at headquarters and one to AML. Steps f through k below should be done with the trailer's air conditioning/heating unit on.

2. Procedure

- a. *Gently screw the half or one-inch microphone (with the protective grid in place) directly onto the connector on the B&K sound level meter. Remember not to force the microphone. If resistance is met, unscrew it and try again. Note: There is no need for the technician to remove the protective grid. The protected surface could be damaged if touched.*
- b. Set the control of the SLM, check the battery condition, and calibrate the SLM according to the previous calibration instructions.

Exhibit 2-4. Environmental noise survey form

NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY III

Environmental Noise Survey

(Date)		(Location)
Band Center Frequency (Hz)	ANSI Max. Allowable Sound Pressure Level for no masking at zero dB	Band level dB/0.0002ubar Air conditioning ON
31.5	(35)	_____
63	(35)	_____
125	35	_____
250	23	_____
500	22	_____
1000	30	_____
2000	35	_____
4000	42	_____
8000	45	_____

Comments: _____

 (Technician)

- c. Change the controls of the SLM as follows:

Range:	0-70 dB
Ext. Filter:	In
Display:	Max Hold
- d. Close both doors to the audiometry room.
- e. Turn off all hearing test equipment and the CNS computer.
- f. On the Octave Band Filter set the Center Frequency select switch to 31.5 Hz.
- g. When ready to measure, press the SLM "Reset" button. The MAX HOLD setting will hold at the highest SPL in the band. Record the sound level shown in the display on the Environmental Noise Survey form.
- h. Select a Center Frequency of 63 Hz on the Filter.
- i. Repeat step g to obtain a new reading.
- j. Proceed through the remaining octave bands from 125 Hz through 8000 Hz, obtaining a sound level reading at each frequency band.
- k. Under "Comments" explain the circumstances, if possible, where the environmental noise levels exceed ANSI allowable levels.
- l. Remove both battery packs when finished.

2.3.3 Daily Procedures

For the daily procedures for setup of audiometry equipment, refer to Sections 2.3.1 and 2.3.2.

2.4 Care and Maintenance of Audiometry Equipment

2.4.1 Cleaning

Prior to conducting audiometric testing, clean the ear cushions with a damp cloth moistened with warm water and a mild detergent. Wipe the surfaces dry afterward.

2.4.2 Malfunctions

For maintenance and malfunction procedures involving the audiometer and earphone cords, refer to Section 2.3.1, #5, 6, and 7.

2.5 End of Stand Procedures

2.5.1 Equipment Breakdown

2.5.2 Packing Supplies and Equipment

A health technician will be assigned by the MEC manager to the audiometry/tympanometry room at the end of the stand to assist in equipment breakdown and packing procedures. All equipment should be cleaned (refer to Section 2.4) prior to securing it for travel. All supplies are to be packed in designated cabinets and storage bins. An inventory of supplies will be conducted at the time. Supply needs are to be communicated to the MEC manager, so that the items can be obtained for the next stand.

2.6 Description of Tympanometry Equipment and Supplies

The equipment and supplies needed to obtain tympanograms are listed below:

Tympanometer - TA-7A Automatic Impedance Meter
Ear Probe Assembly
Eartips Kit
Power Supply Cord
Chart paper

2.6.1 Inventory of Supplies and Equipment

Refer to Section 2.2.1.

2.7 Equipment Setup Procedures

2.7.1 Start of Stand Procedures

Make sure the handheld probe assembly is connected to the PRESSURE and HEADSET connectors of the rear of the unit (A) (see Exhibit 2-5). Since the RS-232 computer interface is being used, make sure the cable is attached to the RS-232 connector (B). Also make sure the power plug is attached to the power connector (C) and that it is plugged into an appropriate receptacle.

For operator comfort, the front panel of the TA-7A can be used either raised or lowered. HINT: If you will be sitting during testing, you may prefer to raise the panel. If you will be standing during testing, you may prefer to lower the panel. To raise the front panel, place finger in the cutout (D) and lift. Reach around panel, push at top of plate (E), allowing it to swing out. Lower panel, making sure the plate is properly positioned against back of recess. To lower the panel, lift slightly, reach behind the panel to press the plate flat, then lower the panel.

Check to see that the printer paper is properly loaded. Also check to see that paper release lever (F) is all the way toward the rear of the unit. Otherwise, the printer will not work.

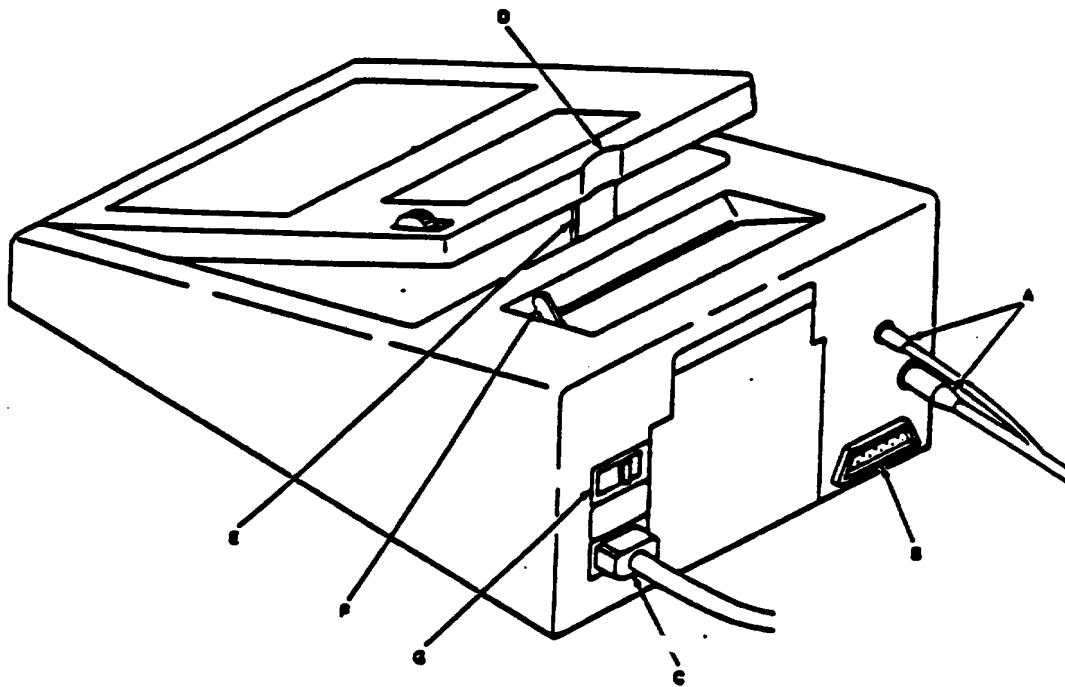
2.7.2 Calibration Procedures

To check the integrity of the system, the health technician should perform an impedance test on himself/herself at the beginning of each examining day. In order to perform this daily check:

- a. Select the proper size ear tip for your ear.
- b. Place the probe assembly in your ear with one hand while gently pulling your ear lobe away from and slightly to the rear of your head with the other hand. The probe light will be blinking red and green.
- c. Hold the probe as still as possible.
- d. If one beep is heard, the test is successfully completed. Remove the probe from the first ear and perform the impedance test on the other ear.

Exhibit 2-5. Tympanometer

The TA-7A



Rear View

- e. If three beeps are heard, the test has aborted. Remove the probe from your ear, wait for the probe light to blink red and green and replace the probe as instructed in b.

2.7.3 Daily Procedures

Refer to previous Section, 2.7.2.

2.8 Care and Maintenance of Tympanometry Equipment

2.8.1 Cleaning and Maintenance

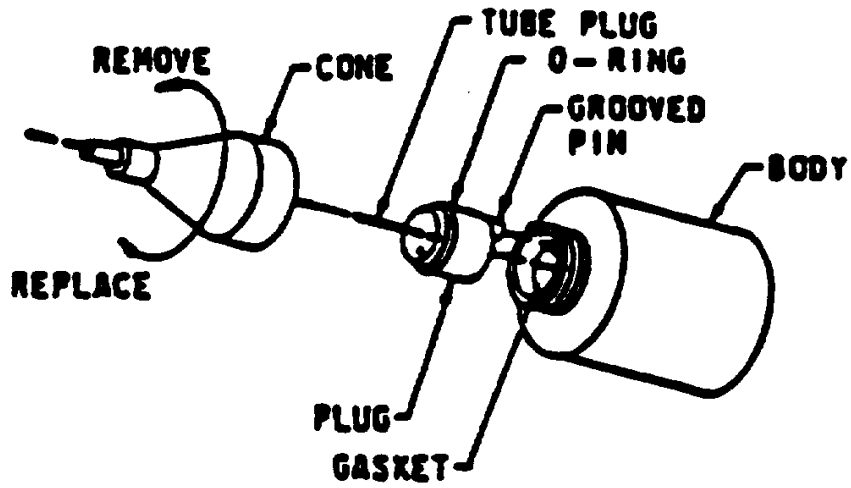
Cleaning the ear probe at regular intervals is essential. It should always be cleaned at the beginning of a stand and then every two weeks. The ear probe should be cleaned more frequently, if necessary, depending on conditions of use, and this will best be determined by the user. Clean the ear probe if abnormal operation is experienced. Refer to the illustration (see Exhibit 2-6) before attempting to open the ear probe.

To disassemble the ear probe, grasp the body in one hand and unscrew the cone. Remove the cone and withdraw the plug. With one of the cleaning wires from the Accessory Kit, clean the bore of the tube plug and the two holes through the plug. Use a dry toothbrush to clean the slots in the tube spacer. Clean inside the cone tube and the surface of the body gasket. Avoid debris in the three body holes that connect to the microphone, receiver, and air supply.

Spray a small quantity of silicone lubricant onto a cotton swab and use this to lubricate the plug O-ring and the body gasket surface. Wipe a small amount on the internal cone threads.

Reassemble the ear probe by placing the plug on top of the gasket keyed by the grooved pin and then screw the cone onto the body. Do not overtighten the cone. Do not lose the gasket or forget to install it properly.

Exhibit 2-6. The ear probe



Clean the cabinet of the tympanometer with a damp cloth moistened with warm water and mild detergent. Wipe the surfaces dry afterward.

When testing is completed for the day, all used ear tips should be thoroughly cleaned. Immersion in and brushing with a Zephirin (benzalkonium chloride) or Betadine (polymerized iodine) solution is recommended. Rinse in hot water and set aside to drain. When dry, dust lightly with powdered talc to prevent stickiness. Store in a clean, dry place.

2.8.2 Malfunctions

The MEC manager should be notified of any problems with the tympanometer. If one or both of the tympanometers are in need of repair, the MEC manager will contact the engineer at headquarters for further instruction regarding the servicing of the equipment.

2.9 End of Stand Procedures

Refer to Section 2.5.

3. EXAMINATION PROTOCOL

3.1 Eligibility Criteria

The age specifications for examinees to receive audiometry and tympanometry testing is six to nineteen (6-19) years. The screening questions that are presented to the examinee prior to testing are to ascertain what conditions, if any, are present that would affect the test results or exclude the examinee from audiometric and tympanogram testing.

3.2 Pre-examination Procedures for Audiometric Testing

At the beginning of each examination session, turn on the audiometer at least ten minutes before doing the daily field check. Both doors to the audiometry room should be closed while testing.

3.3 Examination Procedures

3.3.1 Protocol Procedures for Audiometry

1. General instructions

Perform pure tone audiometric tests for both ears in the sequence indicated. The left ear will be examined first if the examinee number is odd. The right ear will be examined first if the examinee number is even. If, while asking the audiometry questions, you ascertain that the examinee hears better in one ear than the other, test the better ear first. When testing the stated poorer ear, use the masking procedure (item 5) on the better ear for the first signal to ascertain if the difference in thresholds is 40 dB or greater. If it is 40 dB or greater, continue masking; if it is not 40 dB or greater, no further masking will be necessary.

2. Instructions to the technician

- a. Points to be stressed in detail

- (1) The technician should be sure to wash his/her hands between each examinee.
- (2) Prior to using the tympanometer, cleanse the plastic tip with a wipe, and then using the same wipe, cleanse the ear cushions of the audiometer.

3. Instructions to the examinee

a. Points that should be stressed in detail to the examinee

- (1) Tell the examinee that once the earphones are placed by the technician, the examinee must not touch them. The technician should ask if the headphones are comfortable and readjust them if necessary. Never allow the examinee to put on own earphones.
- (2) Tell the examinee that s/he will hear tones that are high and low and that they will become softer and softer until s/he will have difficulty hearing them. When s/he hears a tone, s/he should depress the response button and release it when the tone is no longer heard. Remind him/her to concentrate very hard when the tones are soft.
- (3) Close the test room doors.
- (4) Have the examinee sit adjacent to the technician so that s/he can see the technician, but not observe what the technician is doing or how the equipment is being operated.
- (5) Have the examinee remove eyeglasses, earrings, chewing gum, wigs and hair ornaments if they interfere with proper placement of the headset.
- (6) Have the examinee remove any hearing aids so that audiometry and tympanometry can be conducted.
- (7) Before placing the earphone, make sure the ears are not obstructed with cotton or other foreign objects.
- (8) Facing the examinee, hold the red earphone in your left hand and the blue earphone in right hand. Place the red earphone on the examinee's right ear. Holding the red earphone firmly in place, stretch the headset over the head and place the blue earphone on the examinee's left ear. Tighten or adjust the headband with both hands so that it rests solidly on crown of the examinee's head and exerts full pressure on both ears. Make sure that each earphone is over the ear canal and that it has a good seal against the examinee's ear. Ask the examinee if the headset is comfortable before proceeding with the examination.
- (9) Never place an earphone over an ear that has discharge or drainage. Place the earphone over the normal ear and shorten the headset so that the earphone sits securely on the temple above the draining ear.

- b. Example of verbal instructions for examinees from 7 years of age and up

We are going to see how well you hear some tones from these earphones. You will hear short tones that are both high and low. They will become softer and softer. Each time you hear a tone, please press this button (technician demonstrates with response button) and when you no longer hear the tone let the button up. Listen carefully when the tone starts to get softer, but even if you think you hear it, press the button and I will be able to tell if you hear it. First you will hear the tones in your right/left ear (point) and then in your other ear. If the tone seems to be in this ear (point to nontest ear), please tell me. Remember to press the button when you hear a tone and let it up when you no longer hear it. Do you have any questions? (If so, clarify as necessary. Let the examinee know when you are ready to begin.)

- c. Example of verbal instructions for 6 year olds and immature older children

(Bring the child into position to face the audiometer. With a 50 dB, 1,000 Hz tone in one phone, hold it to the child's ear.) We are going to see how well you can hear some tones from these earphones. Listen to this one. Every time I play a tone, the red light goes on. Do you see it? (Demonstrate.) If you listen carefully and hear the tone, you can turn it off by pressing this button and making the white light go on. (Indicate by depressing response button.) (Hand the response button to the examinee and present the tone, encouraging the child to press the response button. When s/he does, release the stimulus tone. Repeat the sequence at least once or until you feel that the child understands his/her task. Reinforce the child's performance with a positive comment.) Good. Now we will play this game while you sit in that chair. (Indicate the chair and hand the child the response button.) (Place the headset on the child.) First you will hear the tones in this ear (indicate right or left) and then you will hear them in your other ear. Are you ready?

- d. Examples of verbal instructions when masking of the better ear is required (when the difference between the hearing levels of the two ears is 40 dB or greater at any frequency)

Now you will hear the tone in your right/left ear (point to the "poorer" ear). At the same time you will hear a noise, like wind, in your other ear (point to the "better" ear). The noise is to keep you from hearing the tone in that ear, so don't pay any attention to it. I want you to listen for the tones in your right/left ear (point to the "poorer" ear) and press the button whenever you hear them. Do you understand ? (If not, clarify as necessary.)

4. Specific procedure for hearing test

- a. Make sure that the audiometer is ready for the test by checking that it is set as follows:

Channel I

<u>Machine Panel</u>	<u>Correct Setting</u>
Power Switch	On
Channel I Stimulus	Tone
Frequency	1,000 Hz
Decibels	40 dB ¹

Channel II

<u>Machine Panel</u>	<u>Correct Setting</u>
Power Switch	On
Channel II Stimulus	Off (unless using)
Frequency and Input	NB Noise
Decibels	0 or -10 dB ¹

¹ When masking is required, the Channel II Stimulus should be set at 'Off,' the Interrupt Switch should show Channel II "On" on the screen and the decibels should be set at 50 dB.

- b. Review the audiometry questions at the beginning of the procedure. Select the ear to be used following the rules set forth in item 1, General instructions.
- c. Introduce the 1,000 Hz tone to the first ear to be tested at a level of 40 dB for about one second. This should be well within the range of audibility for most examinees and will serve as listening practice. If the tone is not heard at 40 dB, increase the level in 10 dB steps until the examinee responds to it. You will be able to increase the level to 120 dB for the 500-6000 Hz frequencies. A level of 115 dBs is the highest level for testing at the 8000 Hz frequency.
- d. When the examinee responds, set the intensity dial 10 dB below the previous stimulus intensity (30 dB) and present the tone for one or two seconds.
- e. Decrease the level of the tone in 10 dB steps with a minimum of at least one presentation per level until no response is obtained. Obviously, if no response is obtained to the first presentation at least one more stimulus should be presented.
- f. Then increase the intensity dial by 5 dB and present a stimulus.
- g. If a response is obtained at this level, reduce the intensity by 10 dB. If no

response is obtained, increase the intensity by 5 dB. Always descend by 10 dB increments and count the number of responses at the lowest level while ascending in intensity in 5 dB steps.

- h. Enter as the threshold the lowest dial reading at which more than half of the responses are obtained to ascending presentations, that is, two out of three or three out of five trials. Below this level, less than 50 percent response is obtained, and above this level, 100 percent response is approached.
 - i. Repeat the procedure, presenting each successive frequency in the order listed on the examination screen to the test ear, and then shift to the other ear as indicated until the pure tone test has been completed for all frequencies in both ears.
5. Masking procedure is to be used when the difference in thresholds between the two ears is 40 dB or greater at the same frequency. The reason for performing masking, briefly, follows: When a test tone is presented to the poorer ear of an examinee with unilateral or asymmetrical hearing loss, the sound intensity may be such that it is transmitted across the skull and heard in the better ear before it reaches the threshold level in the test ear. This may result in false threshold levels for the poorer ear. In this case, masking is necessary.
- a. At any frequency, regardless if it is just one, when the threshold of one ear is poorer than the other ear by 40 dB or more, retest the poorer ear while using a masking noise in the better ear.
 - b. Inform examinee that there is one additional part of the exam. Remove the headset to explain the masking procedure as described in 3d.
 - c. At each frequency that must be retested, introduce the masking noise at 50 db in the better ear. Then introduce the test tone at 40 db, as usual, in the poorer ear, and re-establish the threshold.
6. Procedure necessary for threshold accuracy
- a. Avoid rhythmic presentation of signals to the examinee. The examinee may respond to the rhythm rather than to the sound. This is especially true of younger persons.
 - b. Avoid the long, drawn-out search for a threshold that tends to lessen the interest and cooperation of the person being tested and to produce fatigue. If necessary, test at another frequency, then return to the problem frequency later. Enter any change in the order of the test in the Comments section.

- c. Avoid giving visual or auditory cues when the tone is presented; for example, looking at the person each time a tone is presented or making a click with the interrupter switch.
- d. Double check the dial readings.
- e. Check whether or not the interrupter switch was in the "off" position.
- f. Avoid activity which will distract the examinee.
- g. Check the response of the examinee occasionally by leaving the tone off for several seconds and then presenting the tone to see if he is responding consistently.
- h. Avoid presentation of the test tone for longer than three seconds. This may lead to a false response.
- i. Count only the ascending responses in determining the threshold.
- j. Avoid being influenced by the threshold obtained for the first 1,000 Hz tone when obtaining the threshold for the second presentation of this tone.
- k. Make sure all computer entries are complete. If the test is not done or incomplete, enter the reason why.

7. Special Problems

A. Testing the Deaf Child

All deaf or "hard of hearing" children should be given audiometry and tympanometry exams. Most deaf children have been tested audiometrically more times than the rest of us ever will. Therefore, they are not completely naive with respect to what to expect when they see an audiometer and have the phones placed on their ears.

Deaf children use either sign language or spoken language, or a combination of the two. If a child relies on signing, ask the family member or guardian to interpret instructions. If the examinee is verbal, face the child when you speak. Speak a little more slowly than usual, without exaggerated face movements. Look directly at the child; do not turn away or put hands in front of face.

- a. Remove hearing aid(s).
- b. Begin at 40 dB and ascend in intensity in 5 dB steps to establish threshold. As in the usual protocol when a response is obtained, descend by 10 dB increments and count the number of responses at the lowest intensity.

- c. Some children will have responses at high thresholds throughout most of the frequency range; others may have hearing at only one or two frequencies or not at all. Some children may tell you, "I can feel that, but not hear it" at high intensity levels. Tactile (feeling) thresholds should not be recorded as auditory thresholds. Search for thresholds as high as 110 dB, ascending in 5 dB steps.
- d. Tympanometry should be performed, as usual.

B. The Uncooperative Child

If a child is very fidgety or loses interest during the exam, the following suggestions may help avoid the long drawn out search for a threshold, and ensure accuracy of results.

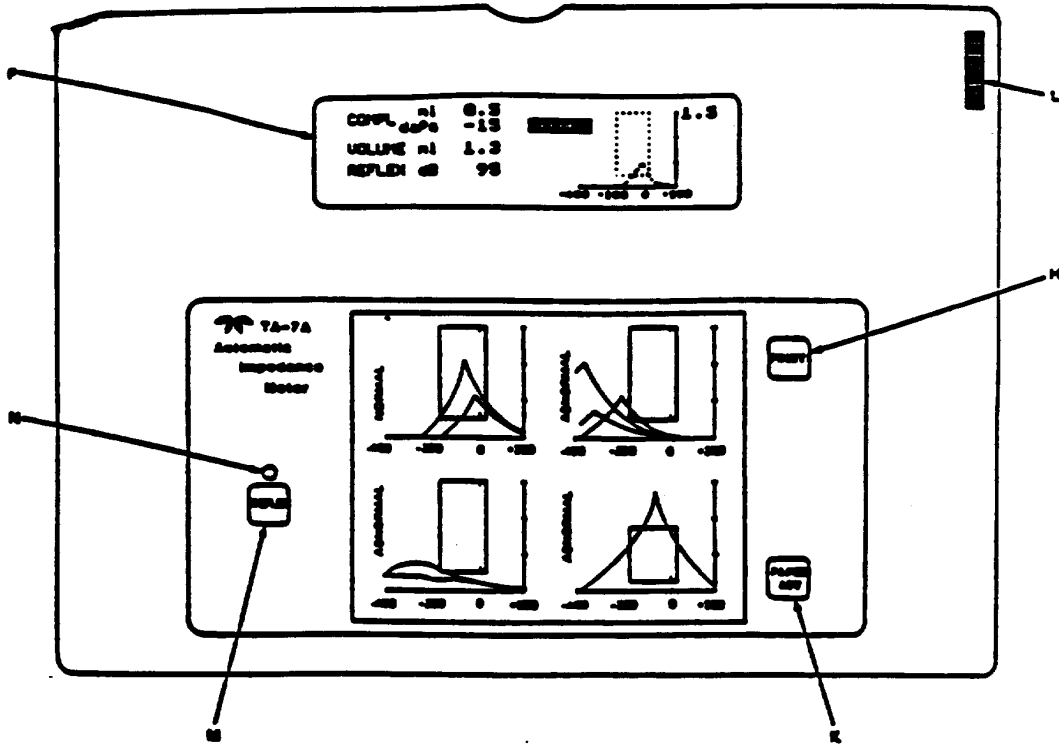
- a. Provide constant verbal reinforcement. Let the child know that he/she is doing a good job. Also, inform the child when he/she has completed a frequency, and to begin again.
- b. Stop the exam for several minutes and get the child a drink of water or juice. Proceed when the child is ready.
- c. Show patience. Your frustration with a bored child will only prolong the examination.

3.3.2 Protocol Procedures for Tympanometry

1. Have the examinee sit in a comfortable, relaxed position (infants and children could be held by a parent). Explain to the examinee what the test involves and why it is being done.
2. Push the PRINT button and hold.
3. Turn on the power switch (G) (Exhibit 2-5) on the rear of the unit. Wait until the Teledyne¹
 - * Avionics logo (J) (Exhibit 3-1) disappears from the display and then release the PRINT button (H) (Exhibit 3-1). When the PAPER ADV. button (K) is pressed, the paper will advance (see Exhibit 3-1).

¹ If the failure message appears after applying power, notify your supervisor. Use thumbwheel (L) to adjust the intensity of the display.

Exhibit 3-1. Tympanometer front panel



Front Panel



4. Press the REFLEX button (M). Observe that the REFLEX test light (N) is on. To eliminate the reflex test, simply press the REFLEX button (M) and observe that the light (N) goes out.²
5. Look in the ear to determine the size and direction of the ear canal. Select an eartip of the proper size to seal the ear canal. Place the ear tip on the hand held probe, making sure it fits snugly against the shoulder of the probe.
6. Lightly pull up and back on the ear to straighten the ear canal. During this procedure, watch the probe light -- it will be blinking red and green. Seal the canal by placing the probe against the ear canal opening. Maneuver the probe slowly until the green light appears on the probe. Hold the probe as still as possible until the green light goes out.
7. Look at the lights on the probe. Do not watch the tympanometer. If you watch the tympanometer, the probe tip may move against the canal wall and void the test. Movement of the probe during the test may cause the test to abort or give false test results. If the probe light changes from green to red and three beeps are heard, the test was aborted. Remove the probe from the ear, wait for the probe light to blink red and green, and then repeat the test in sequence. If the probe light changes from green to red and one beep is heard, the test has been successfully completed.
8. The test results will appear on the screen and automatically be stored in the automated system.

Instructions to the examinee

1. Example of verbal instructions for examinees seven years old and older

This is a test to check the status of your middle ear. In a moment, I'll insert a small rubber tip into your ear. You'll feel a slightly raised pressure in your ear for a moment followed by a beep which ends the exam. If you would like, you may watch the screen recording the mobility of your eardrum while the test is being done. Please don't move, speak, or swallow from the time I place the tip in your ear until I remove it.

² The reflex selection can only be changed when the READY flag appears on the display screen.

3.3.3 Examination Form for Audiometry and Tympanometry

3.3.3.1 Hard Copy Exam Form

Although both the audiometry and tympanometry forms are automated for the main survey, it will still be necessary to know how to record on the hard copy form for those instances when the automated system is down.

The Audiometry and Tympanometry Examination form is used to record SP responses to the screening questions and to record the results of the audiometric (air conduction) and tympanogram tests. An example of the examination form is shown in Appendix A.

The screening questions on the examination form will also be available in Spanish to assist those SPs who do not understand English. A health technician or translator who is fluent in the Spanish language will be available to instruct the SP in the exam procedure. An example of the Spanish test instructions is included in Appendix C.

When using the hard copy form, the technician completes the top section of the form listing staff identification number, the audiometer and tympanometer number and places the SP's bar code ID label in the box labelled "Sample No." After completing the identifier information, the technician asks the examinee the 10 screening questions. If there are no reasons to exclude the examinee from the exam, the technician should begin the testing procedures.

3.3.3.2 Automated System

The automated version of the examination form is designed to duplicate the hard copy form. On the introductory screen the technician will enter his or her staff ID number and the sample person ID number and then select the "air conduction" or "tympanometry" procedure. Exhibit 3-2 shows an example of the introductory screen. Each screening question will appear separately on a screen. The technician is to ask the screening question and type in the response code where the cursor appears on the screen. The <return> key brings up the next screen. Exhibit 3-3 and Exhibit 3-4 are examples of how the screen is displayed for the screening questions.

Exhibit 3-2. Introductory screen

Introduction

Technician	Examinee
Tech# <u>1001</u>	Sample# <u>2222222</u>
Name <u>Bob Murphy</u>	Name <u>test person</u>
	Age <u>12</u> Years/Months <u>Y</u>
	Sex <u>M</u>

Procedures

Air conduction
Tympanometry

Char Mode: Replace Page 1

Count: *2

Exhibit 3-3. Screening question screen

Name test person _____ NCHS# 2222222

Audiometry _____

Have you had a cold or sinus problems within the past week?

- 1 Yes
- 2 No
- 8 No data collected

Char Mode: Replace Page 1

Count: *0

Exhibit 3-4. Screen question screen

Name test person _____ NCHS# 2222222

Audiometry

How many hours ago did the noise end?

<u>1-24</u>	<u>Number of hours</u>
<u>30</u>	<u>Less than one hour</u>
<u>88</u>	<u>No data collected</u>

Char Mode: Replace Page 1

Count: *0

For the audiometry or air conduction exam, the cursor will automatically move to the designated ear to begin testing based on the SP number. Exhibit 3-5 is an example of the test screen.

Examples of the program display screens are included in Appendix B.

Results of Examination

The results screen for audiometry will be displayed after the technician completes the testing. Exhibit 3-6 is an example of the results screen. The technician selects whether the test was done, incomplete, or not done. If "test done" was chosen, comments can be entered, but the system will return to the introductory screen. If "test incomplete" or "test not done" is chosen, another screen will appear so that the reasons can be recorded.

The results screen for tympanometry will be displayed after the procedure is selected on the introductory screen. Exhibit 3-7 is an example of the tympanometry results screen. The technician selects whether the tympanogram was obtained or not obtained for the right ear and for the left ear.

Reasons for Test Incomplete or Test Not Done for Audiometry and Tympanometry

A screen will follow the audiometry and tympanometry examinations in order for the technicians to enter whether examinations have been completed or not.

The reasons for test not done or incomplete are shown in Exhibit 3-8. The technician selects the reason that best describes why the test was not done or completed based on the following definitions:

- **SAFETY EXCLUSION:** Examinee excluded for safety reasons only, per protocol. For example, examinee has discharge or drainage in both ears.
- **REFUSED/UNCOOPERATIVE:** 'Examinee-initiated' non-response. Examinee refused the test for any reason and data cannot be obtained. For example, if the examinee arrived late, or must leave early.

Exhibit 3-5. Audiometry test screen

Name test person Sample# _____ aud.air.1

Audiometer _____	Left Ear Hearing (dB)	Frequency (Hz)	Right Ear Hearing (dB)
	_____	1000	_____
	_____	2000	_____
	_____	3000	_____
	_____	4000	_____
	_____	6000	_____
	_____	8000	_____
	_____	1000	_____
	_____	500	_____

Char Mode: Replace Page 1 Count: *0

Exhibit 3-6. Audiometry results screen

Name person Sample# 6060600

Examination results

Select one

- Test done
- Test incomplete
- Test not done

Comments: _____

Char Mode: Replace Page 1

Count: *3

Exhibit 3-7. Tympanometry results screen

Name sp55 Sample No 555555 aud.tym.1

TYMPANOMETRY SCREEN

Right Ear

- 1 Obtained
- 2 Not obtained

Left Ear

- 1 Obtained
- 2 Not obtained

Char Mode: Replace Page 1

Count: 1

Exhibit 3-8. Reasons test incomplete or not done for audiometry and tympanometry

Name sp55 Sample# 555555

Examination results

Select one

- Hardware malfunction or lack of supplies
- Insufficient time available or room not available
- Examinee refused or uncooperative
- Examinee has pre-existing condition affecting test
- Examinee unable physically to cooperate
- Examinee cannot understand instructions: language
- Examinee cannot understand instructions: other

Comments: _____

Char Mode: Replace Page 1

Count: *7

- **OUT OF TIME:** End of session and no time to conduct the examination.
- **PHYSICALLY UNABLE TO COOPERATE:** Examinee physically not able to perform the test. For example, the examinee cannot wear the head set or operate the button.
- **EXAMINEE UNABLE TO UNDERSTAND INSTRUCTIONS:** Examinee unable to understand instructions to perform the test because of language, cognitive impairment or other communication impairment.
- **EQUIPMENT PROBLEM:** Hardware or software problem. **OTHER REASONS:** Limit use of this code to reasons that cannot be coded with the above categories. For example, the examinee was sent home or excluded by the physician.

3.3.3.3 Question-by-Question Examination Specifications

Question-by-question specifications follow.

This section of the manual contains some brief general directions and question-by-question specifications (QxQ Spex) for the Audiometry and Tympanic Impedance forms. The QxQ spex are designed to help you better understand the **intent** of each question and/or test procedure and to provide you with specific procedures to make the administration of the exam as smooth as possible. Use these specifications as a reference source during the training, interviewing, using the automated system, and during the editing phases of your work. When you have a question about making an entry into the computer, always look at the QxQ spex first to try to resolve the problem. The objective is to achieve comparability without rigidity across technicians in the way they administer, interpret and record for questions and testing procedures.

General Specifications

Before beginning the specific question-by-question review, please note the following general specifications.

- Testing and recording for the left ear will be completed first if the examinee number is odd. Testing and recording for the right ear will be completed first if the examinee number is even. If, while asking the audiometry questions, you ascertain that the examinee hears better in one ear versus the other, then the better ear will be tested and recorded first.

- Read all questions as written.
- If a respondent replies "Don't Know" to a question, probe for an answer. If after the probe, the examinee still maintains the "Don't Know" response, select "8" for no data collected.
- If any part of the test cannot be completed (i.e., the machine fails after testing at 3000 Hz), select "2" for test incomplete and then select the reason in the section entitled, "Reasons test incomplete or not done." If the test is not done (i.e., prior to the beginning of the audiometry testing the examinee refuses to have test done), select "3" test not done in the section for "Results of audiometry examination" and indicate the reason(s) in the section entitled, "Reasons test incomplete or not done."
- Zero filling - When you record an answer involving dates or numbers, all boxes (spaces) must be filled. Zero fill the empty boxes starting from the left. For example, if there are three spaces for the tympanometer number, which is 21, it would be filled in as follows: 0 2 1 .
- Perhaps most important, **listen carefully**. Be aware of exactly what the question is asking and then listen carefully to the respondent's answer so that you are sure s/he is providing the information you have asked for. If you think the respondent has misunderstood the question, probe by repeating the question with a preface such as "Just to make sure I have this right, ..." If the respondent asks for clarification, repeat the question or portion of the question which provides the information s/he needs in order to answer correctly. If there is any misunderstanding, always probe to verify/clarify the response.

Before beginning the audiometry testing, verify the identifying information which appears on the computer screen with the examinee.

Prior to the actual audiometry testing, you will ask the examinee a series of questions:

QA.1 This question asks whether the examinee has had a cold or sinus problems within the past week. A cold for purposes of this study will be defined as a disorder of the upper respiratory track, which may be viral, a mixed infection or an allergic reaction. It is marked by acute discharge from the nose, slight rise in temperature, chilly sensation and general indisposition. Sinus problems will be defined as a condition that causes an inflammation of a sinus. The condition may or may not contain pus, be chronic or acute. It may involve the ethmoid, frontal, maxillary or sphenoid sinus.

Select the "yes" box if the examinee states that s/he has had a cold or sinus problems within

the last seven days and go on to QA.2. Select the "no" box if the examinee states that s/he has not had a cold or sinus problems within the last seven days and skip to QA.3. Select the "no data collected" box if the examinee states that s/he does not know if s/he has had a cold or sinus problems within the last seven days or if the examinee refuses to answer or decides not to complete the testing.

QA.2 This question will only be asked if the examinee answered yes to QA.1 and if the examinee has a cold or sinus problems today. See Q.1 for definition of cold or sinus problems. Note the time frame "TODAY". Select the "yes" box if the examinee states that s/he does have a cold or sinus problems today. Select the "no" box if the examinee states s/he does not have a cold or sinus problems today. Select the "no data collected" box if the examinee states s/he does not know if s/he has a cold or sinus problems today or if the examinee refuses to answer or decides not to complete the testing.

QA.3 This question asks whether the examinee has been exposed to a very loud noise within the past 24 hours. Note the time frame of "24 hours". Select the "yes" box if the examinee states that s/he has been exposed to a very loud noise within the past 24 hours and ask QA.4. Select the "no" box if the examinee states s/he has not been exposed to a very loud noise within the past 24 hours and skip to QA.5. Select the "no data collected" box if the examinee states s/he does not know if s/he has been exposed to a very loud noise within the past 24 hours or if the examinee refuses to answer or decides not to complete the testing.

QA.4 QA.4 will only be asked of those examinees that respond "yes" to QA.3. It asks how many hours ago did the noise end. Enter the number of hours, to the nearest hour, using the rounding rule. Select the "Less than 1 hour" box if the time lapsed is less than one hour.

QA.5 This question asks the examinee if s/he has listened to music with headphones or earphones within the past 24 hours. Note the time frame of "24 hours". Select the "yes" box if the examinee responds yes, s/he has listened to music with headphones or earphones within the past 24 hours. Select the "no" box if the examinee responds that s/he has not listened to music with headphones or earphones within the past 24 hours. Select the "no data collected" box if the examinee states s/he does not know if s/he has listened to music with headphones or

earphones within the past 24 hours or if the examinee refuses to answer or decides not to complete the testing.

- QA.6** QA.6 will only be asked of those examinees that respond "yes" to QA.5. It asks how many hours ago did you stop listening. Enter the number of hours, to the nearest hour, using the rounding rule. Select the "Less than 1 hour" box if the time lapsed is less than one hour.
- QA.7** QA.7 asks the examinee if s/he has had buzzing, ringing or other noises in his/her ears today. Note that the time frame is "today." Select the "no" box if the examinee states that s/he has not had buzzing, ringing or other noises in his/her ears today. Select the "right" box if the examinee states that s/he has had a buzzing, ringing or other noises in the right ear today. Select the "left" box if the examinee states that s/he has had a buzzing, ringing or other noises in the left ear today. Select the "both" box if the examinee states that s/he has had a buzzing, ringing, or other noises in both ears today.
- QA.8** Ask the examinee if s/he has had an earache within the past week. An earache for purposes of this study will be defined as any pain in the ear, regardless of severity. The time frame for this question is the past week or last seven days. Select the "no" box if the examinee states that s/he has not had an earache within the past week. Select the "right" box if the examinee states that s/he has had an earache in the right ear within the past week. Select the "left" box if the examinee states s/he has had an earache in the left ear within the past week. Select the "both" box if the examinee states that s/he has had an earache in both ears within the last week.
- QA.9** QA.9 asks the examinee if s/he now has a tube in the right or left ear. Tube will be defined as when an examinee has had tubes inserted in one or both eardrum(s). Note that the time frame is "now." Select the "no" box if the examinee states that now (at the time of testing) s/he does not have a tube in the right or left ear. Select the "right" box if the examinee states that s/he has a tube in the right ear. Select the "left" box if the examinee states that s/he has a tube in the left ear. Select the "both" box if the examinee states that s/he has a tube in both ears.

If tubes are present in one or both ears, tympanometry will not be conducted.

QA.10 QA.10 asks the examinee if s/he has drainage/discharge from either ear. Drainage/discharge will be defined as an exudate or substance noted in or from the ear which may be watery, purulent (consisting of or containing pus) or bloody. Audiometry and tympanometry exams will be conducted only on the ear without drainage/discharge. It is imperative that the ear cushions (earphones) never be placed on a draining ear. The headset should be shorted and ear cushion placed on the examinee's temple as described in section 3a(8).

QB.1 Air Conduction Results - Left ear. You will be recording the air conduction results for the left ear first if the examinee sample number is odd. In column B.1.a, for each frequency, enter the threshold for the lowest dial reading at which more than half of the responses are obtained to ascending presentations, that is, two or three out of five trials.

In column B.1.c, enter the results when the masking procedure is used. That is, the left ear tested with masking on the right ear.

QB.2 Air Conduction Results - Right ear. You will be recording the air conduction results for the right ear first if the examinee sample number is even. In column B.2.a, for each frequency, enter the threshold for the lowest dial reading at which more than half of the responses are obtained to ascending presentations, that is, two or three out of five trials.

In column B.2.c, enter the results when the masking procedure is used. That is, the right ear tested with masking on the left ear.

4. LOGS AND RECORDS

4.1 Daily Log

The technician conducting audiometry and tympanometry testing will complete two forms for the exam: the audiometry/tympanometry exam form and the "Audio and Impedance Daily Log Sheet." These forms are part of the automated system; however, it is important that the health technician be familiar with the hard copy versions in the event that the automated system is not in operation.

4.1.1 Hard Copy - Audio and Impedance Daily Log Sheet

The audiometry and tympanometry (impedance) daily log sheet will be kept in the exam room. An example of the daily log sheet is shown in Exhibit 4-1. Identifier information is to be completed by the technician in the upper right corner of the form.

- Stand No. - Enter the stand number.
- Location - Enter the stand location.
- Date - Enter the date the testing is being performed.

The log is designed to be able to use the SP barcode ID label and accommodate 10 SP entries (one exam session) per sheet.

- SP ID # - Place the SP ID label in this space.
- Examiner No. - Enter your four-digit ID number.
- Age - Enter the age of the SP, using the rounding rule as applicable.
- Time In/Time Out - Enter the time the SP enters the room and leaves the room.
- Air Conduct - Check this box if the audiometry was completed successfully in both ears and leave the box blank if audiometry was completed successfully in only one ear or not at all. Make a note in the comments section if you were unable to complete the audiometry testing in both ears.

National Health and Nutrition Examination Survey III

AUDIO AND IMPEDANCE DAILY LOG SHEET

Stand No. _____

Location _____

Date ____/____/____

Session No. ____ AM ____ PM ____ EVE

SP ID #	Examiner ID #	Age	Time In / Time Out	Air Conduct.	Impedance Test	Component Completed		Comments
						Yes	No	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	
			__:__/__:			<input type="checkbox"/>	<input type="checkbox"/>	

Exhibit 4-1. Audio and impedance daily log sheet

- Impedance Test - Check this box if the tympanometry was completed successfully in both ears and leave the box blank if tympanometry/audiometry was completed successfully in only one ear or not at all. Make a note in the comments section if you were unable to complete the tympanometry testing in both ears.
- Component Completed - Check one box. You must make a note in the comments section if the component was not done.
- Comments - You must make a note in the comments section if any part of the exam was unsuccessful. You should also make notes to explain any unusual situation.

It is important that all information on the log sheet be recorded as accurately and completely as possible. All entries need to be clear and legible. Any unusual occurrences or problems should be recorded in the "Comments" section so that information can be easily retrieved if needed.

4.1.2 Automated Log Forms

The automated system incorporates the audiometry and tympanometry log form. The introductory screen in the automated program provides for data entry of the necessary identifier information for the SP, the technician, and the time. The comments section on the results screen provides for only unusual occurrences, problems, etc., to be recorded.

4.2 Calibration Logs

Refer to Sections 2.3.1, 2.3.2 for calibration log procedures.

4.3 Shipment of Forms and Logs

Refer to Part 1, Section No. 2, Standardized Procedures for information concerning the shipment of forms and logs from the MEC.

5. QUALITY CONTROL

Quality Control Procedures

To ensure complete and accurate data collection and to document the data collection process, a variety of quality control procedures have been developed for this survey. This section describes procedures to be followed by you and the audiometry consultant.

Editing the Hard Copy of the Audiometry/Tympanometry Form

After filling in information on the hard copy form for Audiometry and Tympanometry while proceeding through the testing process for a particular examinee, the technician should review the form for completeness, accuracy and legibility before the examinee leaves the exam room so that data can be retrieved, if necessary. The technician should make the following checks of the Audiometry and Tympanometry Forms:

On all pages, see that:

- The second digit of all hearing level values must be a "5" or a "0";
- A response has been marked for all appropriate items, keeping the age of the examinee in mind;
- No conflicting responses have been marked for the same item;
- Appropriate skip patterns have been followed; and
- All entries are legible.

Verifying Daily Examinee Schedule

The technician should check off each examinee on the schedule provided by the coordinator as s/he is about to begin the audiometry/tympanometry testing. At the end of each day's session, the technician should review the schedule and check it against the control section of the automated system

to make sure that all examinees who were scheduled were seen by the technician. If any examinees were missed, the technician should notify the coordinator immediately.

Quarterly Observations and Replications

Four times a year, the audiometry/tympanometry consultant will be responsible for observing a sample of about 20 audiometry/tympanometry tests given by the technician. Using an observation checklist, the consultant will observe whether all appropriate frequencies were checked and whether the procedures for the testing were strictly followed, including the position of the examinee, position of the earphones and position of the ear probe for each part of the testing. Any deviation from standard procedures, as well as any problems that arise, will be noted by the consultant.

Variations in procedures and problems will be reviewed with the technician at the end of the day. If problems or other issues are considered to be serious by NCHS or the audiometry/tympanometry consultant, retraining will be scheduled.

In addition to the testing components, the consultant will review a sample of Audiometry and Tympanometry Report Forms for completeness and accuracy.

One other measure of quality control may be instituted - that is, replication of some of the audiometry and tympanometry tests by the consultant. Since it is impractical to ask an examinee to submit to two complete examinations by two examiners, replicate examinations, if feasible at all, may be conducted on the dry run at the beginning of a stand or the day before.

6. SAFETY PROCEDURES

6.1 Equipment Precautions

Environmental - The GSI 16 audiometer meets the ANSI S3.6-1969 standards for temperature and humidity specifications, and it meets the Underwriters Laboratories (UL) 544 standards in terms of shock hazards and leakage.

6.1.1 Infection Control

Procedures that have been developed to prevent the transmission of infections among staff and between SPs and staff include:

- Strict handwashing between each examinee.
- Cleaning of the audiometer ear cushions between SPs.
- Daily cleansing of ear tips used for exam sessions with a disinfectant solution.
- Bi-weekly cleaning of the ear probe and tympanometer.
- Screening SPs to determine if there is any drainage or discharge from one or both ears; if there is a positive response to this particular screening question, the ear cushions are to be cleaned with a damp cloth moistened with disinfectant solution after the SP leaves the exam room.

6.2 SP Movement and Positioning

The SP is to be seated for both the audiometry and tympanometry exams. The SP is positioned so that he/she is adjacent to the technician but facing away from the technician toward the test room doors. This positioning will prevent the SP from being cued to respond to the various frequency levels by observing what the technician is doing or how the equipment is being operated.

6.3 Emergency Procedures

There is no medical risk to SPs that participate in audiometry and tympanometry testing. However, should a medical emergency arise while the SP is being tested, the MEC emergency procedures as discussed in Part I, Section 3 of this manual should be followed. If there is ever a question or concern about the physical condition or status of an SP during the exam, the physician should be notified as per standard MEC procedure.

APPENDIX A

Audiometry/Tympanometry Examination Form

AUDIOMETRY AND TYMPANOMETRY AGES 6-19 YEARS

a. STAFF NO. _____	b. Audiometer No. _____	c. Tympanometer No. _____	d. SAMPLE NO. _____
A. CONDITIONS AFFECTING TEST RESULTS (ALL AGES)			
1. Have you had a cold or sinus problems within the past week?		1 <input type="checkbox"/> yes 2 <input type="checkbox"/> no (Q3)	
2. Do you have a cold or sinus problems today?		1 <input type="checkbox"/> yes 2 <input type="checkbox"/> no	
3. Have you been exposed to a very loud noise within the past 24 hours?		1 <input type="checkbox"/> yes 2 <input type="checkbox"/> no (Q%)	
4. How many hours ago did the noise end?		66 <input type="checkbox"/> Less than 1 hour _____ # hours ago	
5. Have you listened to music with headphones or ear phones within the past 24 hours?		1 <input type="checkbox"/> yes 2 <input type="checkbox"/> no (Q7)	
6. How many hours ago did you stop listening?		66 <input type="checkbox"/> Less than 1 hour _____ # hours ago	
7. Have you had buzzing, ringing or other noises in your ears today?		2 <input type="checkbox"/> No 3 <input type="checkbox"/> Right 4 <input type="checkbox"/> Left 5 <input type="checkbox"/> Both	
8. Have you had an earache within the past week?		2 <input type="checkbox"/> No 3 <input type="checkbox"/> Right 4 <input type="checkbox"/> Left 5 <input type="checkbox"/> Both	
9. Do you now have a tube in your right or left ear?*		2 <input type="checkbox"/> No 3 <input type="checkbox"/> Right 4 <input type="checkbox"/> Left 5 <input type="checkbox"/> Both	

10. Do you have drainage/discharge from either ear?*			2 <input type="checkbox"/> No 3 <input type="checkbox"/> Right 4 <input type="checkbox"/> Left 5 <input type="checkbox"/> Both		
START HERE IF SAMPLE NUMBER ODD			START HERE IF SAMPLE NUMBER EVEN		
B1. AIR CONDUCTION-LEFT EAR			B2. AIR CONDUCTION-RIGHT EAR		
Hearing level (dB) (a)	Frequency (Hz) (b)	Retest L with masking on R** (c)	Hearing level (dB) (a)	Frequency (Hz) (b)	Retest R with masking on L** (c)
	1000			1000	
	2000			2000	
	3000			3000	
	4000			4000	
	6000			6000	
	8000			8000	
	1000			1000	
	500			500	
C. RESULTS OF AUDIOMETRY:			1 <input type="checkbox"/> Test done 2 <input type="checkbox"/> Test incomplete 3 <input type="checkbox"/> Test not done		
REASONS TEST INCOMPLETE OR NOT DONE:			1 <input type="checkbox"/> Hardware malfunction or lack of supplies 2 <input type="checkbox"/> Insufficient time available or room not available 3 <input type="checkbox"/> Examinee refused or uncooperative 4 <input type="checkbox"/> Examinee has pre-existing condition that would affect validity of test 5 <input type="checkbox"/> Examinee unable to physically cooperate 6 <input type="checkbox"/> Examinee unable to understand test instructions due to language barrier 7 <input type="checkbox"/> Examinee unable to understand test instructions due to other reasons 8 <input type="checkbox"/> Comments: _____		
*Tympanometry will not be done if either ear has a tube or drainage. Air conduction will be done only on non-drainage ear(s). **Retest poorer ear with A/C masking on better ear only if difference in A/C-HL between the two ears is 10 dB or more. Only retest at frequencies where there is a difference of 40 dB or more. Do not retest at all frequencies.					

D

TYMPANOMETRY

Right Ear

- 1 Obtained
- 2 Not obtained

Left Ear

- 1 Obtained
- 2 Not obtained

RESULTS OF TYMPANOMETRY:

- 1 Satisfactory Test
- 2 Test Incomplete
- 3 Test not done

REASONS TEST INCOMPLETE OR NOT DONE:

- 1 Software malfunction
- 2 Hardware malfunction or lack of supplies
- 3 Insufficient time available or room not available
- 4 Examinee refused
- 5 Examinee medically excluded by staff for safety
- 6 Examinee has pre-existing condition that would affect validity of test
- 7 Examinee unable to physically cooperate
- 8 Examinee unable to understand test instructions due to language barrier
- 9 Examinee unable to understand test instructions due to other reasons
- 10 Examinee uncooperative
- 11 Comments: _____

APPENDIX B

Examples of Screening Question Screens

Name test person NCHS# 2222222

Audiometry

Have you had buzzing, ringing, or other noises in your ears today?

- 2 No
- 3 Right
- 4 Left
- 5 Both
- 8 No data collected

Char Mode: Replace Page 1

Count: *0

Name test person NCHS# 2222222

Audiometry

Have you had an earache within the past week?

- 2 No
- 3 Right
- 4 Left
- 5 Both
- 8 No data collected

Char Mode: Replace Page 1

Count: *0

Name test person NCHS# 2222222

Audiometry

o you now have a tube in your right or left ear?

- 2 No
- 3 Right
- 4 Left
- 5 Both
- 8 No data collected

Name test person NCHS# 2222222

Audiometry

Do you have drainage/discharge from either ear?

- 2 No
- 3 Right
- 4 Left
- 5 Both
- 8 No data collected

Name test person NCHS# 2222222

Audiometry

Have you listened to music with headphones or earphones
within the past 24 hours?

- 1 Yes
- 2 No
- 8 No data collected

Name test person NCHS# 2222222

Audiometry

How many hours ago did you stop listening?

1-24	Number of hours ago
30	Less than 1 hour
88	No data collected

Name test person NCHS# 2222222

Audiometry

Have you been exposed to a very loud noise within the past 24 hours?

- 1 Yes
- 2 No
- 8 No data collected

Name test person NCHS# 2222222

Audiometry

Do you have a cold or sinus problems today?

1 Yes

2 No

8 No data collected

Char Mode: Replace Page 1

Count: *0

APPENDIX C
Spanish Version
Examination Form

TYMPANOMETRY TEST INSTRUCTIONS

Example of verbal instructions for examinees.

Esta es una prueba para verificar el estado del oído medio. En un momento insertaré un pequeño vástago de goma en su oído. Sentirá una presión ligeramente subida en el oído por un momento, seguido por un sonido corto y agudo con el cual termina el exámen. Si usted quiere, puede mirar la pantalla registrando la movilidad de su tímpano mientras se está haciendo la prueba. Por favor no se mueva, hable, o trague desde el momento en que yo ponga el vástago en su oído hasta que yo lo saque.

AUDIOMETRY TEST INSTRUCTIONS

Initial Instructions

Por favor quítese los anteojos, anillos, pelucas, o adornos para el pelo. Por favor vote el chicle. ¿Tiene algún algodón en sus oídos?

Example of verbal instructions for examinees from 7 years of age up.

Después que le ponga los audífonos en la cabeza, por favor no los toque. ¿Son cómodos los audífonos?

Vamos a ver que tan bien oye algunos tonos desde estos audífonos. Oirá tonos cortos que son tantos, altos y bajos. Estos se pondrán bajos y más bajos. Cada vez que oiga un tono por favor presione este botón (technician demonstrates with response button), y cuando usted ya no oiga el tono, suelte el botón. Escuche cuidadosamente cuando el tono comience a ponerse más bajo pero si usted cree que aún lo oye mantenga el botón presionado así yo podré determinar si usted lo oye o no. Primero oirá los tonos en el oído derecho/izquierdo (point) y después en el otro oído. Si el tono parece estar en este oído (point to nontest ear), por favor dígame. Recuerde apretar el botón cuando oiga un tono y suéltelo cuando no lo oiga más. ¿Tiene alguna pregunta? (If so, clarify as necessary)

Example of verbal instructions for 6-years-olds and immature older children.

(Bring the child into position to face the audiometer. With a 50 dB, 1,000 Hz tone in one phone, hold it to the child's ear.)

Vamos a ver que tan bien oyes algunos tonos desde estos audífonos. Escucha este. Cada vez que yo toco un tono la luz roja se prende. ¿La ves? (Demonstrate) Si escuchas cuidadosamente y oyes el tono puedes apagar la luz roja presionando este botón y haciendo que la luz blanca se prenda. (Indicate by depressing response button. Hand the response button to the examinee and present the tone, encouraging the child to press the response button. When he/she does, release the stimulus tone. Repeat the sequence at least once or until you feel that the child understands his/her task. Reinforce the child's performance with a positive comment.) Bien, Ahora vamos a jugar este juego mientras te sientas en esa silla. (Indicate the chair and hand the child the response button. Place the headset on the child.) Primero vas a oír los tonos en este oído (indicate right or left) y después los vas a oír en el otro oído. ¿Estas listo?

Examples of verbal instructions when masking of the better ear is required (when the difference between the hearing levels of the two ears is 40 dB or greater at any frequency).

Ahora escucharás el tono en el oído derecho/izquierdo (point). Al mismo tiempo vas a oír un ruido, como viento, en el otro oído (point). El ruido es para evitar que oigas el tono con ese oído, así es que no le prestes atención a esto. Quiero que escuches los tonos en el oído derecho/izquierdo (point) y presiones el botón cuando lo oigas. ¿Entiendes? (If not, clarify as necessary.)

AUDIOMETRY AND TYMPANOMETRY (AGES 6-19 YEARS)			
a. STAFF NO.	b. Audiometer No.	c. Tympanometer No.	d. NCHS ID No.
_____	_____	_____	_____
A. CONDITIONS AFFECTING TEST RESULTS (ALL AGES)			
1. ¿Ha tenido un resfriado o problema de los senos nasales durante la pasada semana?	1 <input type="checkbox"/> S	2 <input type="checkbox"/> N	
2. ¿Tiene un resfriado o problema de los senos nasales hoy?	1 <input type="checkbox"/> S	2 <input type="checkbox"/> N	
3. ¿Ha estado expuesto a un ruido muy alto durante las 24 horas pasadas?	1 <input type="checkbox"/> S	2 <input type="checkbox"/> N	
4. ¿Cuántas horas hace que terminó el ruido?	<input type="checkbox"/> menos de 1 hora ___ # horas atrás		
5. ¿Ha escuchado música con audífonos durante las 24 horas pasadas?	1 <input type="checkbox"/> S	2 <input type="checkbox"/> N	
6. ¿Cuántas horas hace que terminó el ruido?	<input type="checkbox"/> menos de 1 hora ___ # horas atrás		
7. ¿Ha tenido zumbido, silbido u otros ruidos en los oídos hoy?	2 <input type="checkbox"/> N (To O6) 3 <input type="checkbox"/> Derecho 4 <input type="checkbox"/> Izquierdo 5 <input type="checkbox"/> Ambos		
8. ¿Ha tenido un dolor de oídos durante la semana pasada?	2 <input type="checkbox"/> N (To O6) 3 <input type="checkbox"/> Derecho 4 <input type="checkbox"/> Izquierdo 5 <input type="checkbox"/> Ambos		
9. Ahora, ¿tiene usted un tubo en el oído derecho o el oído izquierdo?	2 <input type="checkbox"/> N (To O6) 3 <input type="checkbox"/> Derecho 4 <input type="checkbox"/> Izquierdo 5 <input type="checkbox"/> Ambos		
10. ¿Tiene drenaje/descarga de alguno de los oídos?	2 <input type="checkbox"/> N (To B) 3 <input type="checkbox"/> Derecho 4 <input type="checkbox"/> Izquierdo 5 <input type="checkbox"/> Ambos		

PHS 6314-3
REV. 04/88