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| Procedure No. TEB-CBRN-APR-STP-0313 | Revision: 2.0 | Date: 31 October 2007 |
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DETERMINATION OF COMMUNICATION PERFORMANCE TEST FOR SPEECH CONVEYANCE AND INTELLIGIBILITY OF CHEMICAL BIOLOGICAL RADIOLOGICAL AND NUCLEAR (CBRN) FULL-FACEPIECE AIR-PURIFYING RESPIRATOR (APR) STANDARD TESTING PROCEDURE

1. PURPOSE

- 1.1. This test establishes the procedures for ensuring that the level of speech conveyance and intelligibility provided by the Communication Performance Test on Chemical Biological Radiological and Nuclear (CBRN) Full Facepiece Air-Purifying Respirator (APR) submitted for Approval, or Extension of Approval, or examined during Certified Product Audits, meet the minimum certification standards set forth in 42 CFR Part 84, Subpart G, Section 84.63(a)(c)(d) and the Statement of Standard for Chemical, Biological, Radiological and Nuclear (CBRN) Full-Facepiece Air-Purifying Respirator (APR) dated 3-7-2003.
- 1.2. The purpose of this test is to quantify the performance of a respirator in transmitting intelligible speech of a human test subject. This is accomplished by determining a listener's ability to comprehend single-syllable words spoken by a subject wearing the respirator.

2. GENERAL

- 2.1. This STP describes the Communication Performance Tests for Speech Conveyance and Intelligibility of the CBRN APR in sufficient detail that a person knowledgeable in the appropriate technical field can select equipment with the necessary resolution, select the appropriate human subject test panel, conduct the test, and determine whether or not the product passes the test.
- 2.2. The Communication Performance Test shall be performed through the use of the Modified Rhyme Test (MRT) to evaluate a listener's ability to comprehend single words from a speaker. Both listeners and speakers shall be in combinations of masked and unmasked postures during the MRT to provide an indication of speech transmission and intelligibility.
- 2.3. This test is considered a human factors test that requires participation of 8 test subjects to quantify the performance rating of a respirator to transmit intelligible speech.

|             |              |             |              |
|-------------|--------------|-------------|--------------|
| Approvals:  |              |             |              |
| First Level | Second Level | Third Level | Fourth Level |

### 3. EQUIPMENT/MATERIALS

#### 3.1. Test Subjects

3.1.1. Test administrators: Shall have successfully completed the CDC/ATSDR Scientific Ethics Training, DHHS/NIH Human Participant Protections Education for Research Teams or an equivalent course.

3.1.1.1. Administrator 1 shall have the duties of monitoring the test speakers' speech. Administrator 1 shall also monitor the actions of the listener group to make sure they are responding to the test speaker and not misbehaving during the test.

3.1.1.2. Administrator 2 shall monitor the dBA level of the test speaker and give verbal or nonverbal feedback as to loudness of his/her speech. Administrator 2 shall also record the dBA level on the Respirator Communication Performance Test Data Collection Sheet (see 8.4).

3.1.2. Eight test subjects are required for this test. All procedures and requirements specified in the NIOSH Human Subject Review Board (HSRB) Protocol HSRB-04-NPPTL-02XP entitled, "Protocol for the Certification and Quality Assurance Testing of Respirators" shall be followed and met.

3.1.3. The eight test subjects shall be divided into two groups, a listener group comprised of three subjects (at least one female and one male) and a speaker group comprised of five subjects (at least one female and one male).

3.1.4. All test speakers and listeners shall be fluent in English. In addition, these subjects shall have no obvious or strong regional or foreign accents.

3.1.5. The eight test subjects shall be trained in the donning and use of the respirator per manufacturer's instructions by the test administrator.

3.1.6. Each subject shall be sized and fitted for the respirator per manufacturer's instructions. Where an individual is qualified to wear multiple sizes of the respirator, the subject shall select the respirator size that provides the most comfortable fit.

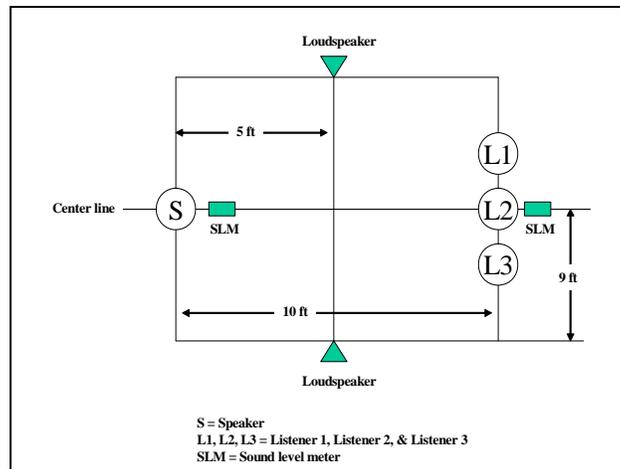
3.1.7. The subjects shall have normal hearing as defined in the HSRB Protocol (see 3.1.2.).

3.1.8. The test subjects shall not have any facial hair or conditions that may cause interference with the seal of the respirator facepiece.

#### 3.2. Test Equipment

3.2.1. Permanent Marker

- 3.2.2. Measuring tape, foot & inch, minimum 20 feet length.
- 3.2.3. Test laboratory that permits an unobstructed 10 +1/-0 ft distance between test speaker and the listener group when facing one another. Figure 1 contains a diagram of the subject and equipment positioning for the Modified Rhyme Test setup.



**Figure 1. Modified Rhyme Test setup diagram**

- 3.2.4. Noise Plug, Precision Pink Noise Test Generator (GTC Industries) or equivalent for producing pink noise in the frequency range of 20.0 Hz to 50.0 kHz. Accuracy: 3dB per octave rolloff from 20 Hz to 20 KHz. Pink noise is defined as an audio test signal that contains all the frequencies in the audio spectrum with equal energy in each octave. Pink noise contains less energy in the higher audio frequencies than in the lower ones.



**Figure 2. Noise Plug, Precision Pink Noise Generator (GTC Industries)**

- 3.2.5. The stereo amplifier is positioned outside the room and used to transmit and amplify the background noise.
- 3.2.6. The two loudspeakers are positioned midway between test speaker and listeners. Details of the exact positioning of the speaker equipment are further defined in Section 5.3.2
- 3.2.7. Two Type 2 digital sound level meters (Sper Scientific, LTD, Model 840029) with an "A" weighting decibel scale of 30 to 130 dB or equivalent. One sound

level meter will be positioned in front of the Test Speaker and the second sound level meter will be positioned at head level beside listener L2 (see figure 1).



**Figure 3. Sper Scientific LTD digital sound level meter, Model 840029**

3.2.8. Sper Scientific, LTD Acoustical calibrator (model 840031) or equivalent is used to calibrate the sound level meters.



**Figure 4. Acoustical calibrator (Sper Scientific model 840031)**

3.2.9. Twelve word lists from the Modified Rhyme Test (MRT). These twelve word lists are separated onto individual sheets to be used by the test speakers during the test (see 8.1)

3.2.10. Test listeners' multiple choice answer pages on the laptops or equivalent. Modified Rhyme Test listener responses are recorded and scored using laptops that have been programmed for this application; otherwise, the manual method using the multiple choice answer sheets can be employed (see 8.2).

3.2.11. Sound and/or audiovisual recording device for recording speech.

#### 4. TESTING REQUIREMENTS AND CONDITIONS

- 4.1. Prior to beginning any testing, all measuring equipment to be used must have been calibrated in accordance with the testing laboratory's procedure and schedule. All measuring equipment utilized for this testing must have been calibrated using a method traceable to the National Institute of Standards and Technology (NIST) when available.
- 4.2. Any laboratory using this procedure to supply certification test data as a contractor to NIOSH will be subject to the provisions of the NIOSH Supplier Qualification Program (SQP). This program is based on the tenets of *ISO/IEC 17025, the NIOSH Manual of Analytical Methods* and other NIOSH guidelines. An initial complete quality system audit and follow on audits are requirements of the program. Additional details of the Program and its requirements can be obtained directly from the Institute.\*  
\*Note 4.2 does not apply to Pretest data from applicants as required under 42 CFR 84.64.
- 4.3. Precision and accuracy (P&A) must be determined for each instrument in accordance with laboratory procedures and NIOSH/NPPTL guidance. Sound practice requires, under *NIOSH Manual of Analytical Methods*, demonstrating a tolerance range of expected data performance of a plus or minus 25% of a 95% confidence interval of the stated standard requirement. NIOSH/NPPTL P&A tolerance can be higher but not lower.
- 4.4. Normal laboratory safety practices must be observed.
- 4.4.1. All electrical equipment cables and wires must be covered or fastened securely to the floor by a rug or tape to eliminate trip hazards.
- 4.4.2. Worktables must be maintained free of clutter and non-essential test equipment.
- 4.4.3. All large test equipment such as the stereo amplifier, speakers, and noise generator shall be securely anchored to eliminate toppling hazards.

#### 5. PROCEDURES

- 5.1. Fill in the Pretest data on the Respirator Communication Performance Test Data Collection Sheet (see 8.3).
- 5.2. Record the background noise of the room without any external noise, at the center listener's head position, on the Respirator Communication Performance Test Data Collection Sheet.

### 5.3. Test Equipment Set-Up.

#### 5.3.1. Room Selection.

The room selected to perform the MRT shall be of ample size to comfortably house all the test equipment indicated in Figure 1 and the personnel associated with the test. It shall be free of external noise interference.

#### 5.3.2. Equipment Positioning

The test equipment shall be arranged in accordance with the diagram of Figure 1. The loudspeakers shall be positioned such that their forward axes are oriented toward one another at a height of approximately 29.5 inches from the floor and they are 9 +0.5/-0 ft from the center of the sound field between the test speaker and listeners. The laptops will be placed directly in front of the listeners at a convenient distance away.

### 5.4. Training of the Test Speakers.

5.4.1. Without the listeners in the room, one subject at a time will be seated in the test speaker's position and be given an individual MRT word list from section 8.1. A sound level meter will be positioned in front of the test speaker at a convenient distance as a guide concerning the loudness of their voice during reading of the word list. The sound level meter shall be set to display "A"-weighted sound levels.

5.4.2. Test administrator 1 shall be seated beside the test speaker to monitor the reading of the word list. The administrator shall instruct the test speaker to read, without placing any unusual emphasis on any stimulus word, at a rate of approximately one phrase every 6 seconds, using the introductory phrase "The word is (list word)". In addition, the test speaker shall be directed to communicate each word without using any visual gestures, such as hand signals, and without repeating any of the list words.

5.4.3. Test administrator 2 shall be seated in the center test listener's position and instruct the test speaker to begin reading the word list at a voice level of 75 to 85 dBA.

5.4.4. During the reading of the word list, test administrator 2 will monitor the "A"-weighted output volume of the speaker and provide feedback as to the loudness of the speaker's performance throughout the reading of the word list. Test administrator 1 will provide feedback to the test speaker regarding the pronunciation of the list words and the rate of performance. Additional training will be done if warranted per the judgment of the test administrators. These procedures will be completed without the use of a respirator and without any background noise above ambient conditions.

5.4.5. Additionally, training with background noise of  $60 \pm 2$  dBA consisting of a pink noise will also be completed according to the above procedures in section 5.4.

#### 5.5. Training of the Test Listeners.

5.5.1. The three test listeners shall be seated facing a single test speaker at a distance of 10 ft. The listeners shall be seated next to one another with approximately one foot between them. Each listener will be given a laptop with a list of multiple choice words for recording his or her responses. Alternate means for recording the test listener's responses such as paper answer sheets, are acceptable (see 8.2).

5.5.2. An MRT word list will be provided to a trained test speaker. The test speaker will be instructed to communicate the word list to the test listeners as was done during speaker training.

5.5.3. As a group, listeners will be instructed to listen attentively as the test speaker reads 50 words to them each with the introductory phrase "The word is (list word)." The test listeners shall be directed to select, or make a best guess of the word, that was perceived to be spoken from the six possible response words provided to them on the laptops. Test listeners shall also be instructed to provide a "thumbs-up" hand signal to the speaker as a cue to say the next phrase.

5.5.4. During the reading of the word list, administrator 2 will monitor the A-weighted output volume of the speaker at the listening position and provide feedback as to the loudness throughout the reading of the word list. In addition, test administrator 1 will provide the test speaker feedback regarding the rate of performance. Administrator 1 will also monitor the actions of the listener group and provide additional instructions as needed. Additional training will be done if warranted per the judgment of the test administrators. These procedures will be completed without the use of a respirator and without any background noise above ambient conditions.

5.5.5. Additionally, training with background noise of  $60 \pm 2$  dBA consisting of a pink noise will also be completed according to the above procedures.

#### 5.6. Conducting the Test.

5.6.1. The noise generator shall be turned on and set to produce  $60 \pm 2$  dBA of pink noise, as measured by the sound level meter at the center test listener's head position without listeners present. This value shall be recorded on the Respirator Communication Performance Test Data Collection Sheet.

5.6.2. The three test listeners shall be seated in the listening position with a laptop located conveniently in front of them.

5.6.3. A test speaker will then be positioned in the speaking position and present one complete MRT word list to the listening panel. A different test speaker shall then

be used to present the next MRT trial. Test speakers will continue to rotate among the speaker test panel until all trials have been completed.

- 5.6.4. Data will be obtained without the respirator and with the respirator worn and operated per the manufacturer’s instructions by both speakers and listeners. All conditions shall be randomly assigned and a different word list shall be used for each test. A test matrix of the MRT conditions is provided in Table 2 to assist the test administrator in establishing the sequence of testing.

Table 2. MRT Trial Matrix

| Trial # | Speaker | With or Without Mask | Word list |
|---------|---------|----------------------|-----------|
| 1       | 1       | No mask              | 11A       |
| 2       | 2       | No mask              | 3A        |
| 3       | 3       | Masked               | 5A        |
| 4       | 4       | Masked               | 7A        |
| 5       | 5       | No mask              | 4A        |
| 6       | 2       | Masked               | 12A       |
| 7       | 4       | No mask              | 5A        |
| 8       | 1       | Masked               | 1A        |
| 9       | 5       | Masked               | 8A        |
| 10      | 3       | No mask              | 6A        |

- 5.6.5. Background noise levels shall be monitored at the center test listener’s head position and recorded, on the Respirator Communication Performance Test Data Collection Sheet, at the beginning, middle, and end of each MRT session by administrator 2.
- 5.6.6. The test speakers shall be monitored and recorded during the test to determine if the test speakers conform to the word list specified for each trial by test administrator 1. Test administrator 1 shall also make note of any improperly pronounced or misspoken words by the test speakers.
- 5.6.7. A total of 10 MRT trials shall be performed. The 10 trials will result in a total of 15 MRT scores (five per listener) for the unworn mask condition and 15 scores for the worn condition.

5.7. Data Analysis.

- 5.7.1. Use the Respirator Communication Performance Test Data Collection Sheets, to assist with the analysis of the ten MRT for each listener.
- 5.7.2. The number of correct responses shall be adjusted for chance or guessing made possible by the multiple-choice form of the answer sheet using the equation:

$$\text{Adjusted Score} = \frac{\text{Number of Correct Listener Responses}}{\text{Number of Listener Responses}} - \frac{\text{Number of Wrong Listener Responses}}{\text{Number of Listener Responses}}$$

5.7.3. Determine the Number of Words Spoken Correctly by the speakers from either the Test Administrators notes or if necessary, by listening to the Audio recorder tapes.

5.7.4. Listener performance on the MRT shall be scored in terms of the percentage of words correctly identified using the equation for both the masked and unmasked posture:

$$\% \text{ Correct} = (\text{Adjusted Score} / \text{Number of Words Spoken Correctly}) * 100$$

5.7.5. Average Unmasked and Average Masked % Correct Scores shall be calculated for each individual listener.

5.7.6. Each individual listener's Average Masked % Correct Score shall be divided by their Average Unmasked % Correct Score to calculate a Performance Rating using the equation:

$$\text{Performance Rating (\%)} = \left( \frac{\text{Average Masked \% Correct Score}}{\text{Average Unmasked \% Correct Score}} \right) \times 100$$

5.7.7. The performance rating of all listeners shall then be averaged to determine the Overall Performance Rating of the CBRN APR using the following Equation:

$$\text{Overall Performance Rating (\%)} = \frac{\text{Performance Rating (\%)}_{L1} + \text{Performance Rating (\%)}_{L2} + \text{Performance Rating (\%)}_{L3}}{3}$$

6. PASS/FAIL CRITERIA

6.1. The criterion for passing this test is set forth in 42 CFR, Part 84, Subpart G, Section 84.63(a)(c)(d) and the Statement of Standard for Chemical, Biological, Radiological and Nuclear (CBRN) Full-Facepiece Air-Purifying Respirator (APR) dated 3-7-2003.

6.2. A candidate CBRN APR must obtain an Overall Performance Rating greater than or equal to 70% to meet the Communication requirement.

7. RECORDS/TEST SHEETS

7.1. All test data shall be recorded on the Respirator Communication Performance Test Data Collection Sheets.

8. ATTACHMENTS

8.1. CBRN APR Communication Performance Word List Test Sheets

8.2. CBRN APR Communication Performance Test Listener Data Sheet

8.3. Respirator Communication Performance Test Data Collection Sheet

**Section 8.1**  
**CBRN APR Communication Performance Word List Test Sheets**

**List 1A**

1. The word is **but**
2. The word is **kit**
3. The word is **peak**
4. The word is **pig**
5. The word is **cold**
6. The word is **sick**
7. The word is **pat**
8. The word is **beat**
9. The word is **hot**
10. The word is **fit**
11. The word is **sung**
12. The word is **sent**
13. The word is **rest**
14. The word is **mat**
15. The word is **top**
16. The word is **sack**
17. The word is **day**
18. The word is **heal**
19. The word is **name**
20. The word is **pay**
21. The word is **must**
22. The word is **pun**
23. The word is **hen**
24. The word is **cud**
25. The word is **book**
26. The word is **late**
27. The word is **led**
28. The word is **same**
29. The word is **pin**
30. The word is **feel**
31. The word is **soil**
32. The word is **fizz**
33. The word is **park**
34. The word is **bash**
35. The word is **till**
36. The word is **male**
37. The word is **dud**
38. The word is **sin**
39. The word is **tack**
40. The word is **case**
41. The word is **bang**
42. The word is **thaw**
43. The word is **ray**
44. The word is **dig**
45. The word is **team**
46. The word is **win**
47. The word is **seek**
48. The word is **bun**
49. The word is **feat**
50. The word is **sip**

**List 2A**

1. The word is **bus**
2. The word is **kick**
3. The word is **peas**
4. The word is **fig**
5. The word is **hold**
6. The word is **lick**
7. The word is **pass**
8. The word is **beach**
9. The word is **pot**
10. The word is **bit**
11. The word is **sub**
12. The word is **went**
13. The word is **west**
14. The word is **map**
15. The word is **cop**
16. The word is **sap**
17. The word is **pay**
18. The word is **heath**
19. The word is **tame**
20. The word is **pale**
21. The word is **gust**
22. The word is **pus**
23. The word is **then**
24. The word is **cuss**
25. The word is **cook**
26. The word is **lace**
27. The word is **bed**
28. The word is **save**
29. The word is **pit**
30. The word is **reel**
31. The word is **boil**
32. The word is **fib**
33. The word is **bark**
34. The word is **bad**
35. The word is **fill**
36. The word is **gale**
37. The word is **duck**
38. The word is **sit**
39. The word is **tap**
40. The word is **cane**
41. The word is **sang**
42. The word is **saw**
43. The word is **race**
44. The word is **dim**
45. The word is **teak**
46. The word is **din**
47. The word is **seethe**
48. The word is **run**
49. The word is **meat**
50. The word is **dip**

**List 3A**

1. The word is **bug**
2. The word is **kin**
3. The word is **peach**
4. The word is **rig**
5. The word is **gold**
6. The word is **tick**
7. The word is **pan**
8. The word is **beak**
9. The word is **got**
10. The word is **hit**
11. The word is **sup**
12. The word is **rent**
13. The word is **best**
14. The word is **math**
15. The word is **hop**
16. The word is **sad**
17. The word is **gay**
18. The word is **heap**
19. The word is **fame**
20. The word is **page**
21. The word is **bust**
22. The word is **puff**
23. The word is **ten**
24. The word is **cup**
25. The word is **took**
26. The word is **lake**
27. The word is **shed**
28. The word is **safe**
29. The word is **pig**
30. The word is **eel**
31. The word is **toil**
32. The word is **fill**
33. The word is **lark**
34. The word is **bath**
35. The word is **will**
36. The word is **tale**
37. The word is **dung**
38. The word is **sill**
39. The word is **tang**
40. The word is **cave**
41. The word is **rang**
42. The word is **jaw**
43. The word is **raze**
44. The word is **dip**
45. The word is **teal**
46. The word is **pin**
47. The word is **seem**
48. The word is **fun**
49. The word is **heat**
50. The word is **rip**

**List 4A**

1. The word is **bun**
2. The word is **kill**
3. The word is **peace**
4. The word is **big**
5. The word is **told**
6. The word is **kick**
7. The word is **pad**
8. The word is **bean**
9. The word is **lot**
10. The word is **kit**
11. The word is **sum**
12. The word is **bent**
13. The word is **vest**
14. The word is **man**
15. The word is **mop**
16. The word is **sat**
17. The word is **say**
18. The word is **hear**
19. The word is **game**
20. The word is **pave**
21. The word is **dust**
22. The word is **puck**
23. The word is **men**
24. The word is **cuff**
25. The word is **hook**
26. The word is **lane**
27. The word is **fed**
28. The word is **sale**
29. The word is **pip**
30. The word is **peel**
31. The word is **coil**
32. The word is **fit**
33. The word is **mark**
34. The word is **bat**
35. The word is **bill**
36. The word is **bale**
37. The word is **dub**
38. The word is **sing**
39. The word is **tam**
40. The word is **cape**
41. The word is **hang**
42. The word is **law**
43. The word is **rake**
44. The word is **dill**
45. The word is **tease**
46. The word is **fin**
47. The word is **seen**
48. The word is **gun**
49. The word is **seat**
50. The word is **hip**

**List 5A**

1. The word is **buck**
2. The word is **king**
3. The word is **peat**
4. The word is **dig**
5. The word is **fold**
6. The word is **wick**
7. The word is **pack**
8. The word is **bead**
9. The word is **not**
10. The word is **wit**
11. The word is **sun**
12. The word is **tent**
13. The word is **test**
14. The word is **mad**
15. The word is **pop**
16. The word is **sass**
17. The word is **way**
18. The word is **heat**
19. The word is **same**
20. The word is **pane**
21. The word is **just**
22. The word is **pup**
23. The word is **pen**
24. The word is **cut**
25. The word is **shook**
26. The word is **lay**
27. The word is **red**
28. The word is **sane**
29. The word is **pill**
30. The word is **keel**
31. The word is **oil**
32. The word is **fig**
33. The word is **hark**
34. The word is **ban**
35. The word is **hill**
36. The word is **pale**
37. The word is **dun**
38. The word is **sick**
39. The word is **tab**
40. The word is **cake**
41. The word is **fang**
42. The word is **raw**
43. The word is **rate**
44. The word is **did**
45. The word is **teach**
46. The word is **sin**
47. The word is **seed**
48. The word is **sun**
49. The word is **neat**
50. The word is **tip**

**List 6A**

1. The word is **buff**
2. The word is **kid**
3. The word is **peal**
4. The word is **wig**
5. The word is **sold**
6. The word is **pick**
7. The word is **path**
8. The word is **beam**
9. The word is **tot**
10. The word is **sit**
11. The word is **sud**
12. The word is **dent**
13. The word is **nest**
14. The word is **mass**
15. The word is **shop**
16. The word is **sag**
17. The word is **may**
18. The word is **heave**
19. The word is **came**
20. The word is **pace**
21. The word is **rust**
22. The word is **pub**
23. The word is **den**
24. The word is **cub**
25. The word is **look**
26. The word is **lame**
27. The word is **wed**
28. The word is **sake**
29. The word is **pick**
30. The word is **heel**
31. The word is **foil**
32. The word is **fin**
33. The word is **dark**
34. The word is **back**
35. The word is **kill**
36. The word is **sale**
37. The word is **dug**
38. The word is **sip**
39. The word is **tan**
40. The word is **came**
41. The word is **gang**
42. The word is **paw**
43. The word is **rave**
44. The word is **din**
45. The word is **tear**
46. The word is **tin**
47. The word is **seep**
48. The word is **nun**
49. The word is **beat**
50. The word is **lip**

**List 7A**

1. The word is **lick**
2. The word is **beat**
3. The word is **puff**
4. The word is **cook**
5. The word is **tip**
6. The word is **rave**
7. The word is **hang**
8. The word is **till**
9. The word is **math**
10. The word is **sale**
11. The word is **same**
12. The word is **peal**
13. The word is **kit**
14. The word is **sat**
15. The word is **sin**
16. The word is **gold**
17. The word is **buff**
18. The word is **lay**
19. The word is **nun**
20. The word is **must**
21. The word is **pad**
22. The word is **din**
23. The word is **sit**
24. The word is **win**
25. The word is **teak**
26. The word is **dent**
27. The word is **sub**
28. The word is **led**
29. The word is **tot**
30. The word is **dub**
31. The word is **pip**
32. The word is **seen**
33. The word is **way**
34. The word is **west**
35. The word is **pace**
36. The word is **bat**
37. The word is **mop**
38. The word is **big**
39. The word is **tab**
40. The word is **case**
41. The word is **name**
42. The word is **soil**
43. The word is **fin**
44. The word is **cuff**
45. The word is **heal**
46. The word is **hark**
47. The word is **heat**
48. The word is **then**
49. The word is **law**
50. The word is **bean**

**List 8A**

1. The word is **wick**
2. The word is **neat**
3. The word is **puck**
4. The word is **took**
5. The word is **rip**
6. The word is **ray**
7. The word is **sang**
8. The word is **will**
9. The word is **man**
10. The word is **gale**
11. The word is **safe**
12. The word is **peas**
13. The word is **kid**
14. The word is **sass**
15. The word is **sick**
16. The word is **hold**
17. The word is **but**
18. The word is **lane**
19. The word is **bun**
20. The word is **just**
21. The word is **pan**
22. The word is **dig**
23. The word is **bit**
24. The word is **pin**
25. The word is **tease**
26. The word is **sent**
27. The word is **sup**
28. The word is **red**
29. The word is **not**
30. The word is **dung**
31. The word is **pig**
32. The word is **seem**
33. The word is **day**
34. The word is **rest**
35. The word is **page**
36. The word is **bash**
37. The word is **shop**
38. The word is **fig**
39. The word is **tam**
40. The word is **cane**
41. The word is **same**
42. The word is **toil**
43. The word is **fill**
44. The word is **cuss**
45. The word is **feel**
46. The word is **bark**
47. The word is **heath**
48. The word is **ten**
49. The word is **thaw**
50. The word is **bead**

**List 9A**

1. The word is **pick**
2. The word is **meat**
3. The word is **pub**
4. The word is **look**
5. The word is **sip**
6. The word is **rake**
7. The word is **fang**
8. The word is **bill**
9. The word is **mat**
10. The word is **male**
11. The word is **sane**
12. The word is **peach**
13. The word is **kill**
14. The word is **sack**
15. The word is **sill**
16. The word is **cold**
17. The word is **bug**
18. The word is **lace**
19. The word is **sun**
20. The word is **gust**
21. The word is **pass**
22. The word is **dim**
23. The word is **fit**
24. The word is **fin**
25. The word is **teach**
26. The word is **went**
27. The word is **sum**
28. The word is **wed**
29. The word is **hot**
30. The word is **dud**
31. The word is **pill**
32. The word is **seethe**
33. The word is **pay**
34. The word is **vest**
35. The word is **pace**
36. The word is **back**
37. The word is **top**
38. The word is **rig**
39. The word is **tap**
40. The word is **cave**
41. The word is **game**
42. The word is **foil**
43. The word is **fit**
44. The word is **cup**
45. The word is **eel**
46. The word is **park**
47. The word is **heap**
48. The word is **pen**
49. The word is **paw**
50. The word is **beam**

**List 10A**

1. The word is **kick**
2. The word is **feat**
3. The word is **pup**
4. The word is **book**
5. The word is **lip**
6. The word is **rate**
7. The word is **bang**
8. The word is **fill**
9. The word is **mass**
10. The word is **tale**
11. The word is **sale**
12. The word is **peak**
13. The word is **king**
14. The word is **sag**
15. The word is **sip**
16. The word is **told**
17. The word is **bun**
18. The word is **lake**
19. The word is **gun**
20. The word is **bust**
21. The word is **pat**
22. The word is **did**
23. The word is **kit**
24. The word is **tin**
25. The word is **tear**
26. The word is **bent**
27. The word is **sun**
28. The word is **shed**
29. The word is **pot**
30. The word is **duck**
31. The word is **pin**
32. The word is **seed**
33. The word is **gay**
34. The word is **test**
35. The word is **pave**
36. The word is **bath**
37. The word is **pop**
38. The word is **pig**
39. The word is **tan**
40. The word is **cape**
41. The word is **came**
42. The word is **boil**
43. The word is **fib**
44. The word is **cud**
45. The word is **keel**
46. The word is **lark**
47. The word is **heave**
48. The word is **den**
49. The word is **saw**
50. The word is **beat**

**List 11A**

1. The word is **tick**
2. The word is **heat**
3. The word is **pus**
4. The word is **hook**
5. The word is **dip**
6. The word is **raze**
7. The word is **gang**
8. The word is **hill**
9. The word is **mad**
10. The word is **bale**
11. The word is **save**
12. The word is **peace**
13. The word is **kin**
14. The word is **sad**
15. The word is **sit**
16. The word is **fold**
17. The word is **bus**
18. The word is **late**
19. The word is **run**
20. The word is **rust**
21. The word is **pack**
22. The word is **dill**
23. The word is **wit**
24. The word is **din**
25. The word is **teal**
26. The word is **rent**
27. The word is **sung**
28. The word is **bed**
29. The word is **lot**
30. The word is **dug**
31. The word is **pick**
32. The word is **seek**
33. The word is **say**
34. The word is **best**
35. The word is **pay**
36. The word is **ban**
37. The word is **hop**
38. The word is **dig**
39. The word is **tang**
40. The word is **cake**
41. The word is **fame**
42. The word is **coil**
43. The word is **fig**
44. The word is **cut**
45. The word is **peel**
46. The word is **mark**
47. The word is **heal**
48. The word is **men**
49. The word is **jaw**
50. The word is **beach**

**List 12A**

1. The word is **sick**
2. The word is **seat**
3. The word is **pun**
4. The word is **shook**
5. The word is **hip**
6. The word is **race**
7. The word is **rang**
8. The word is **kill**
9. The word is **map**
10. The word is **pale**
11. The word is **sake**
12. The word is **peat**
13. The word is **kick**
14. The word is **sap**
15. The word is **sing**
16. The word is **sold**
17. The word is **buck**
18. The word is **lame**
19. The word is **fun**
20. The word is **dust**
21. The word is **path**
22. The word is **dip**
23. The word is **hit**
24. The word is **sin**
25. The word is **team**
26. The word is **tent**
27. The word is **sud**
28. The word is **fed**
29. The word is **got**
30. The word is **dun**
31. The word is **pit**
32. The word is **seep**
33. The word is **may**
34. The word is **nest**
35. The word is **pane**
36. The word is **bad**
37. The word is **cop**
38. The word is **wig**
39. The word is **tack**
40. The word is **came**
41. The word is **tame**
42. The word is **oil**
43. The word is **fizz**
44. The word is **cub**
45. The word is **reel**
46. The word is **dark**
47. The word is **hear**
48. The word is **hen**
49. The word is **raw**
50. The word is **beak**

**Section 8.2**  
**CBRN APR Communication Performance Test Listener Data Sheet**

NIOSH Application Number \_\_\_\_\_ Date: \_\_\_\_\_  
 Respirator Manufacture: \_\_\_\_\_ ; MRT/Sheet# \_\_\_\_\_  
 Respirator Type: \_\_\_\_\_ ; Speakers Respirator Number, if worn \_\_\_\_\_ (Indicate if unworn)  
 Listener's Respirator (circle one):    Unworn    Worn    If Worn, Listeners Respirator Number \_\_\_\_\_  
 Listener #: \_\_\_\_\_    Listening Position: \_\_\_\_\_    Speaker #: \_\_\_\_\_    MRT Word List#: \_\_\_\_\_

|    |  |    |  |    |  |       |  |
|----|--|----|--|----|--|-------|--|
| 1  | but    bug    bus<br>buff    bun    buck       | 14 | map    mat    math<br>mad    mass    man       | 27 | wed    fed    bed<br>led    shed    red      | 40    | cake    came    Cave<br>cane    case    cape   |
| 2  | kin    kid    kick<br>king    kit    kill      | 15 | hop    cop    shop<br>mop    pop    top        | 28 | sane    sake    safe<br>save    same    sale | 41    | fanq    banq    hanq<br>sang    gang    rang   |
| 3  | peak    peach    peas<br>peal    peace    peat | 16 | sack    sad    sap<br>sag    sat    sass       | 29 | pit    pin    pig<br>pill    pick    pip     | 42    | law    saw    paw<br>jaw    raw    thaw        |
| 4  | dig    wig    big<br>fig    pig    rig         | 17 | say    pay    may<br>gay    way    day         | 30 | heel    peel    keel<br>feel    eel    reel  | 43    | rake    rate    ray<br>raze    race    rave    |
| 5  | fold    sold    gold<br>hold    cold    told   | 18 | heath    heave    heap<br>heat    heal    hear | 31 | toil    boil    foil<br>coil    oil    soil  | 44    | dip    dim    din<br>dill    did    dig        |
| 6  | kick    lick    sick<br>tick    wick    pick   | 19 | tame    came    fame<br>same    name    game   | 32 | fig    fizz    fit<br>fib    fin    fill     | 45    | tear    teal    teak<br>team    tease    teach |
| 7  | path    pack    pass<br>pat    pad    pan      | 20 | page    pane    pace<br>pave    pale    pay    | 33 | mark    bark    dark<br>lark    hark    park | 46    | tin    fin    sin<br>win    pin    din         |
| 8  | beat    beak    beach<br>beam    bean    bead  | 21 | dust    gust    must<br>bust    just    rust   | 34 | bash    bat    ban<br>back    bath    bad    | 47    | seethe    seek    seen<br>seed    seep    seem |
| 9  | pot    hot    lot<br>not    tot    got         | 22 | pun    puff    pup<br>pub    pus    puck       | 35 | will    hill    kill<br>bill    fill    till | 48    | run    bun    fun<br>sun    nun    gun         |
| 10 | fit    hit    bit<br>sit    kit    wit         | 23 | then    den    ten<br>pen    hen    men        | 36 | pale    sale    bale<br>gale    male    tale | 49    | neat    beat    seat<br>meat    feat    heat   |
| 11 | sup    sub    sud<br>sum    sun    sung        | 24 | cuss    cud    cup<br>cut    cub    cuff       | 37 | duck    dud    dung<br>dun    dug    dub     | 50    | lip    hip    dip<br>sip    rip    tip         |
| 12 | dent    tent    rent<br>went    sent    bent   | 25 | hook    shook    book<br>took    cook    look  | 38 | sit    sip    sill<br>sick    sin    sing    | Score |  |
| 13 | best    west    nest<br>vest    test    rest   | 26 | late    lake    lay<br>lame    lane    lace    | 39 | tack    tan    tab<br>tang    tam    tap     |       |  |

**Section 8.3**  
**CBRN APR Communication Performance Test Data Collection Sheet**

**TN # :** \_\_\_\_\_ **MRT Trial # :** \_\_\_\_\_ **Speaker ID # :**  
\_\_\_\_\_

**Word List # :** \_\_\_\_\_ **Please Circle:**    Masked    Unmasked

**Number of words correctly spoken by the MRT Speaker:** \_\_\_\_\_

**Listener #1 ID:** \_\_\_\_\_

- 1. % of Words Answered Correctly = \_\_\_\_\_
- 2. Adjusted Score = \_\_\_\_\_

**Listener #2 ID:** \_\_\_\_\_

- 1. % of Words Answered Correctly = \_\_\_\_\_
- 2. Adjusted Score = \_\_\_\_\_

**Listener #3 ID:** \_\_\_\_\_

- 1. % of Words Answered Correctly = \_\_\_\_\_
- 2. Adjusted Score = \_\_\_\_\_

**Background Noise (w/o pink noise):** \_\_\_\_\_

**Pink Noise Before Session:** \_\_\_\_\_

**Pink Noise Middle of Session:** \_\_\_\_\_

**Pink Noise After Session:** \_\_\_\_\_

### Revision History

| <b>Revision</b> | <b>Date</b>       | <b>Reason for Revision</b>  |
|-----------------|-------------------|---|
| 0               | 15 September 2004 | Historic document   |
| 1.1             | 22 December 2005  | Update header and format<br>No changes to method  |
| 2.0             | 31 October 2007   | Significant changes – Section 4.3 added to address required precision and accuracy of instrumentation; changes to Table 2; additional word lists, and deleted instructions specific to having the test performed by a third-party laboratory. |
|                 |                   |   |
|                 |                   |   |