North Dakota Department of Environmental Quality
Odor Certification Guideline

I. Objective

The objective of this guideline is to set forth a systematic method for certifying individuals as odor inspectors.

II. General

The odor inspector should represent the "average" person and not be insensitive to odor detection. Because all individuals do not have an "average" sense of smell, the goal of the odor certification program is to screen out individuals who are insensitive to odor detection. In order to quantify odor sensitivity, the screening procedure is based on the results of three odor tests[1]: 1) the triangle test, 2) the intensity test, and 3) the multicomponent test. These tests are a measure of a person's sense of smell. Candidates pass each test by achieving a score within a range considered average for the population tested (i.e., for a normal distribution this is the mean score ± one standard deviation). Candidates passing all three tests will be certified as odor inspectors. Certification will be valid for a period of one year.

III. Certification Procedures

The following procedures should be used to prepare for and conduct the odor certification tests. Since a number of factors can influence an individual's test score (i.e. test atmosphere, type and intensity of odors), strict adherence to the following procedures is necessary to be properly evaluated.

A. Triangle Test

1. Objective – The objective of this test is to assess the candidate's ability to distinguish between two odors.

2. Testing and Scoring – The candidate is presented a set of three bottles with odor samples; two of the three bottles have the same odor; however, the three bottles are colored differently. The candidate's task is to pick out the bottle having the odd odor. The candidate identifies the odd odor and indicates that choice by entering the color of the odd sample on the Odor Evaluation Score Sheet (Figure 1). The candidate is presented with a total of five different sets of samples. Scoring is based

[1] From J. Wittes, and A. Turk, "The Selection of Judges for Odor Discrimination Panels," Correlation of Subjective-Objective Methods in the Study of Odors and Taste, ASTM STP 440, American Society for Testing and Materials, 1968, pp. 49-70.

on the number of incorrect choices; the best possible score is 0 and the worst possible score is 5.

3. Sample Preparation – Five sets of samples with equivalent odor concentrations are prepared (Table 1). The first set is prepared by adding drops of the same scent extract (i.e. orange, lemon, cinnamon, etc.) to two of the bottles and by adding equivalent drops of a different scent extract to the third. The bottles are then filled with distilled water. For identification, the contents of each bottle should be colored differently (i.e. red, green, yellow, or blue); this can be done by adding one drop of food coloring to each bottle. Preparation of the remaining four sets of samples should follow the same procedures as indicated for the first set using equivalent drops of scent extracts. Below is an example of a sample set that could be utilized for testing.

Sample Set:			
	1. Orange	Orange	Banana*
	2. Wintergreen	Cherry	Cherry
	3. Banana*	Banana*	Watermelon
	4. Lemon	Lemon	Orange
	5. Cinnamon	Cinnamon	Wintergreen

*Amyl Acetate

B. **Intensity Rating Test**

1. Objective – The objective of this test is to assess the candidate's ability to distinguish the intensity of an odor from a series of twenty bottles, progressively diluted by a factor of 2, which are arranged in order according to intensity.

2. Testing and Scoring – The strongest odor (greatest intensity) will be to the far left and the weakest odor (lowest intensity) will be to the far right. One of the sample bottles is removed by the test facilitator; it is the candidate's task to replace it in the correct position and then note the position on the Odor Evaluation Score Sheet (Figure 1). The test facilitator should select four bottles in advance and use the same numbers throughout a test series to ensure test uniformity.

   Scoring is based on the square of the difference between the position where the candidate places the sample and the correct position. A score of 0 is given to correct placement, 1 if the candidate places the sample one position off from the correct spot, 4 if two positions off, 9 if three positions off, and 16 if four or more positions off from the correct position. The test is repeated for a total of four sets of samples and an average is calculated for the four tests; therefore, the best score is 0, and the worst score is 16 (64 ÷ 4).

3. Sample Preparation – Label twenty glass bottles (1 - 20) on the bottom of each bottle. Using a 10 ml pipet, add 10 ml of propylene glycol to each bottle. To bottle number 1 add 10 ml of amyl acetate and mix well. Remove 10ml from bottle 1 and transfer to bottle 2 and mix well. Remove 10 ml from bottle 2 and transfer to bottle

3 and mix well. Continue this procedure until all twenty bottles are prepared. Discard 10 ml from bottle 20 so only 10 ml remains. A spare set of samples should be prepared in the event that a bottle is spilled or broken during the test.

C. **Multicomponent Test**

1. Objective – The objective of this test is to assess the candidate's ability to distinguish different odors in a sample containing two or more odors.

2. Testing and Scoring – The candidate is given three bottles with different odor samples. Two bottles contain a mixture of two equivalent odors, and the third bottle contains a mixture of three equivalent odors, respectively. The candidate's task is to identify which odors are in the sample bottles using nine reference odors. For each sample bottle, the choices are entered by name on the Odor Evaluation Score Sheet (Figure 1). Scoring is based on the total number of incorrect odors identified for the three sample bottles. The best score is 0 and the worst is 7 (2+2+3) if the candidate failed to correctly identify an odor in any of the three sample bottles.

3. Sample Preparation – Prepare the first sample bottle by adding equivalent concentrations of two of the nine scent extracts listed in Table 1. Fill the bottle with distilled water and add one drop of food coloring to mask any color the scent extracts might have. Prepare the second sample bottle in a similar manner by adding two of the nine possible scent extracts. Prepare the third sample bottle in a similar manner by adding three scent extracts. A reference bottle for each scent extract listed is prepared by adding the equivalent concentration plus two additional drops to a bottle. Fill each reference bottle with distilled water and add a drop of food coloring. Label each reference bottle according to the scent extract used to create the odor.

FOR THE NORTH DAKOTA DEPARTMENT
OF ENVIRONMENTAL QUALITY

Date 9/17/2019

By _____
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Director
Division of Air Quality

Table 1. Odor Equivalent Concentrations

Scent Extract	Equivalent Drops
Amyl Acetate (Banana)	1
Cinnamon*	5
Wintergreen*	5
Watermelon*	3
Strawberry*	6
Lemon*	4
Cherry*	6
Orange*	5
Anise*	8

*Scents obtained from using LorAnn Oils.

Figure 1

Air Pollution Control
Odor Evaluation Score Sheet

Name: _____ Date: _____

Affiliation: _____

Triangle Test:

Instructions: Two of the three bottles in each numbered set have contents with the same odor. Your task is to determine which odor is different from the other two. You do not have to identify the odor. On the numbered lines below, which correspond to each numbered set of three bottles, enter the color of the bottle that you determine has the odd odor.

1. _____ 2. _____ 3. _____

4. _____ 5. _____ Score: _____

Multicomponent Odor Identification Test:

Instructions: Nine labeled bottles have contents with common odors; these will be your reference standards and you may smell them whenever you wish. Three numbered bottles contain a mixture of two or more of the common or standard odors. Bottles No. 1 and No. 2 each contain two odors. Bottle No. 3 contains three odors. One the numbered lines below, write down which odors are present in each of the numbered bottles.

1. _____ _____ 2. _____ _____

3. _____ _____ _____ Score: _____

Intensity Rating Test:

Instructions: All twenty bottles contain the same type of odor but vary in intensity. The strongest odor is in bottle No. 1 on the left, and the weakest odor is in bottle No. 20 on the right. One of the bottles has been removed from its normal position in the series. Your task will be to indicate the proper location of the bottle in the series of 20 bottles. For example, if the odor in the removed bottle appears to be weaker than the bottle which is seventh from the left, but stronger than the eighth bottle from the left, you would be concluding that the removed bottle was actually number 8 in the series and would enter "8" on line No. 1. The test will be repeated three more times with bottles of different intensities being removed. Remember, the odors will be getting stronger toward the left and you will fatigue your sense of smell temporarily if you sniff the more intense odors too long.

1. _____ 2. _____ 3. _____ 4. _____ Score: _____