

# Elaborated Odor Test for Extended Exposure

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Presented by Vanessa D. Buchanan

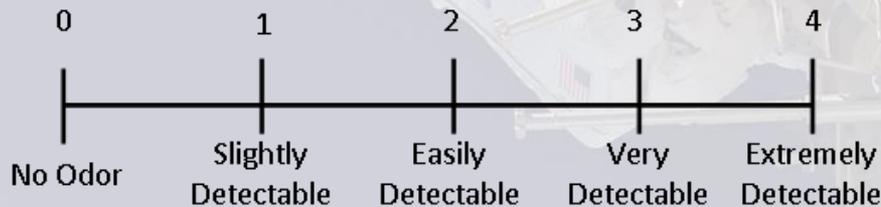
# Standard Odor Testing

- NASA White Sands Test Facility (WSTF) has performed odor testing for several decades.
- Standard Odor Testing is now an optional supplemental test as part of NASA-STD-6001
- Members smell three 30-mL aliquots of test atmosphere
- Less than 10 seconds of total exposure
- Screening test for selection of material with little to no odor



# Odor Panel

- Odor Panel Members are all volunteers
- Approved by NASA Dispensary Staff
- Must pass a 10-bottle test
- Rate odor on 0-4 scale



Odor Potency Rating	Description
Slightly Detectable	A barely detectable odor other than that from the mask and tube. If you walked into a room with this odor, you would vaguely notice odor.
Easily Detectable	An easily detectable odor. If you walked into a room with this odor, you would immediately and clearly notice its presence.
Very Detectable	A strong odor that you may still consider tolerable. If you walked into a room with this odor, you would immediately be struck by its strength.
Extremely Detectable	An overpowering odor. It is possible that the odor may cause any of the following: a burning sensation, tearing, pain, coughing, nausea, aftertaste, or headache. If you walked into a room with this odor, you would feel the need to evacuate.

# Odor Containment Testing

- Additional type of odor testing
- Evaluates the effectiveness of a configuration or article to contain odors
- Used with Standard Odor Test as a single test or various odor tests on the same sample over time
- Examples of past odor containment tests include:
  - UCB
  - TUBSS
  - ISS Food Trash Bag

# Comparative Odor Testing

- Additional type of odor testing
- Used for selection of optimal configuration using a side-by-side odor test comparison
- Test performed using identical odor panel members on the same day

# Need for Extended Duration Odor Test

- What if a material with known odor is selected for use due to other preferred properties?
- Data gaps for standard odor test
  - No evaluation of odors that may become more objectionable over time
  - No evaluation of physical effects caused by odors over time
  - No simulation of realistic exposure dilutions

# Extended Duration Odor Test Development

- No evaluation of odors that may become more objectionable over time
  - Test exposure was expanded from < 10 seconds to maximum of 15 minutes
- No evaluation of physical effects caused by odors over time
  - Evaluation form was expanded to collect data on physical effects during the test and 15 minutes after completion.
- No simulation of realistic exposure dilutions
  - Sample was placed in the center of a small room (12x13 ft) rather than direct injection of test atmosphere through a mask
  - Doors were closed and air handlers disabled to minimize dilution but allow for natural diffusion of odor

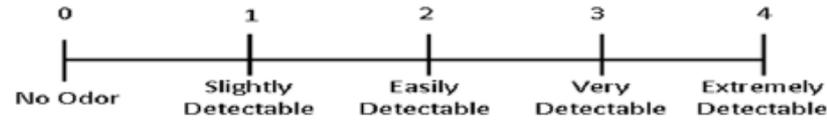


## Odor Panel Test Results

Odor Panel Member: \_\_\_\_\_ Date: \_\_\_\_\_ Time: \_\_\_\_\_

Standard Exposure: \_\_\_\_\_ Non-Standard Exposure: \_\_\_\_\_

**1. Rate first impression of odor potency.**



**2. Decide which general assessment applies and circle in the table below for each exposure:**

Non Irritating (NI), Neutral (N), Pleasant (P), Irritating (I), Revolting (IR)

**3. Describe Odor.** Examples: pungent, rancid, alcohol, ammonia, sweet, intermittent, fruity etc.

**4. Describe any effects.** Examples: teary, burning, tingling, nausea, dizziness, gagging, light-headed, headache, cotton mouth, fatigue, euphoria, irritable, anxious, fidgety, frustrated, etc.

Test Subject Data						Completed by Lead Scientist	
#	Exposure Duration	Potency Rating	General Assessment	Odor Description	Effects Description	WSTF #	Dilution
1	STD		NI, N, P, I, R				
2	STD		NI, N, P, I, R				
3	STD		NI, N, P, I, R				
4	STD		NI, N, P, I, R				
5	STD		NI, N, P, I, R				
6	STD		NI, N, P, I, R				
7	STD		NI, N, P, I, R				
8	STD		NI, N, P, I, R				
9	STD		NI, N, P, I, R				
10	STD		NI, N, P, I, R				
11	STD		NI, N, P, I, R				
12	STD		NI, N, P, I, R				
13	STD		NI, N, P, I, R				

**4. If leaving test before completion please explain why:** \_\_\_\_\_

\_\_\_\_\_

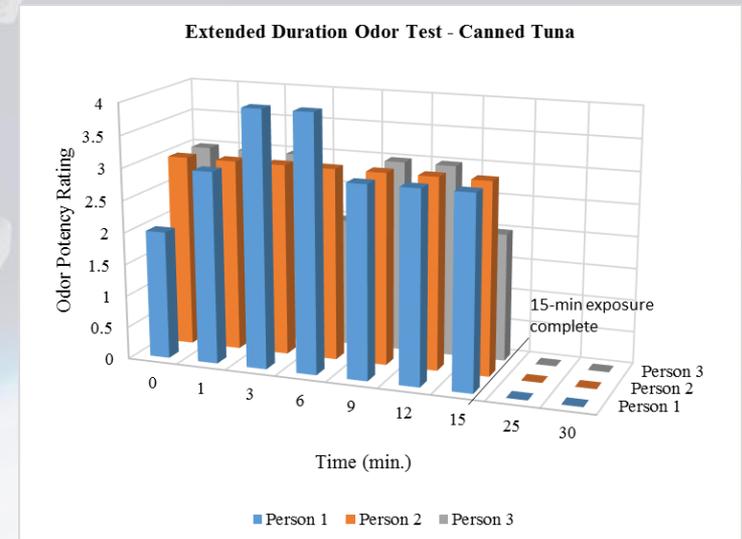
Post Test 3 bottle Test Odor Sensitivity Verification			
	Odor	Odor	Blank
Bottle Number			

Obtain posttest medical exam, preferably within 3 hrs. If cannot attend, obtain examination at dispensary within 24 hrs post test. Perform 10 bottle test posttest if have not done so within the last 4 months. Obtain physical if have not done so within the last 10 years.

# Odor Test Data Form

# Method Development Tests

- Nontoxic known odiferous food samples were used (Vinegar and Canned Tuna)
- Method Improvements
  - Panel members leave testing room at 15 minutes
    - Strong vinegar odor remained after removing samples at 15 minutes, therefore exposure exceeded 15-minute safety requirement
  - Wafting sample
    - Maximum odor detection
  - Rotation around sample
    - To minimize positional effects

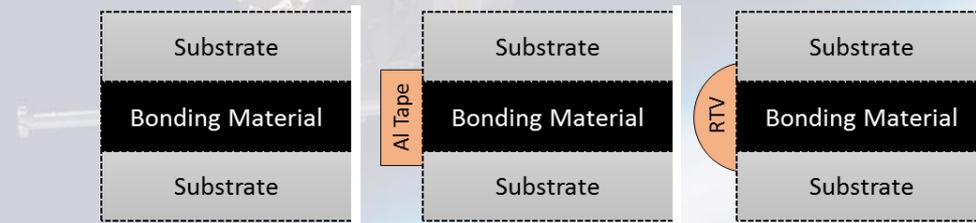


# Test Method Validation

- Method Development Tests confirmed physical effects were effectively evaluated
  - Test subjects reported burning eyes, headache, and frustration throughout the 15-min exposure.
  - These effects were, however, not reported during the posttest analysis points after the odor exposure had ended.
  - The collected data verified that the designed test methodology effectively met its desired intent, adequately assessing long-term and physical effects that may arise out of odor exposure and how these effects vary after exposure has ended.

# Bonding Material Odor Tests

- A **Standard-Comparative-Odor Containment** test was performed on 2 bonding material configurations.
- An **Extended Exposure-Comparative-Odor Containment** test was then performed on the same 2 bonding material configurations the next day, using the same odor panel



- **Sample configurations.** Cross-section of the initial bonding material sample a) without odor containment, b) Sample A with aluminum (Al) tape sealant as odor containment, and c) Sample B with RTV sealant as odor containment.

# Standard Odor Test Data

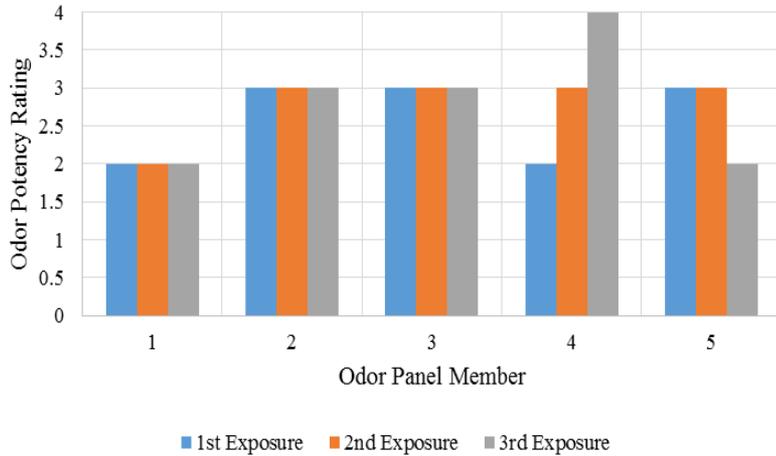
Configuration	Average Potency	General Assessment	Odor Descriptions	Effects Descriptions
Sample A	2.7	N, I	Styrofoam, chemical, model glue, paint, airplane glue, solvent, adhesive, sharp, citrus	None, tingling
Sample B (~4/5 Dil. ~30-min prior)	2	N, NI, I	Styrofoam, chemical, model glue, paint, airplane glue, solvent, adhesive, tangy, fragrant, citrus	None, tingling, burning

General Assessment: Non-irritating (NI), Neutral (N), Pleasant (P), Irritating (I), Revolting (R)

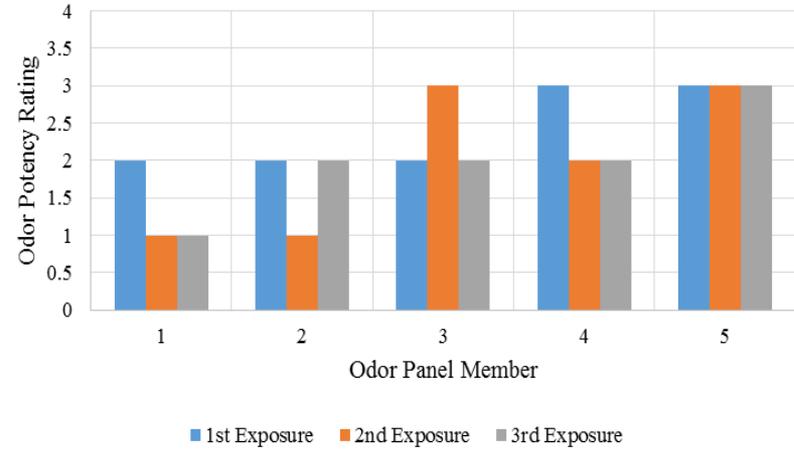
Potency Scale: No Odor (0), Slightly Detectable (1), Easily Detectable (2), Very Detectable (3), Extremely Detectable (4)

# Standard Odor Test Data

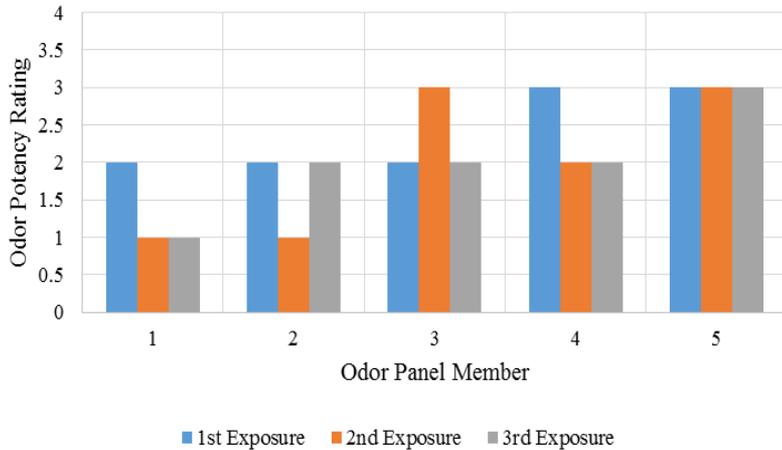
Standard Odor Test - Sample A (Al Tape Sealant)



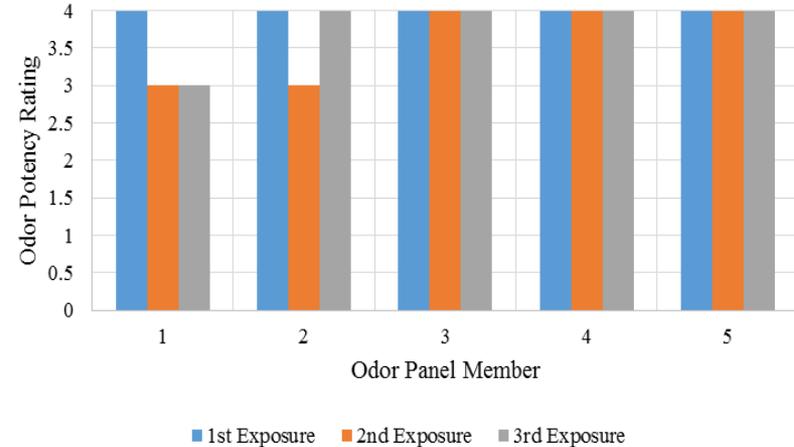
Standard Odor Test - Sample B (RTV Sealant) 4/5 Dilution



Standard Odor Test - Sample B (RTV Sealant) 4/5 Dilution



Standard Odor Test - Sample B (RTV Sealant) Extrapolated



- **Supplemental standard exposure individual odor potency results.** Results for the supplemental standard (<10 s) odor tests for a) Sample A (Al tape sealant) and b) Sample B (RTV sealant, 4/5 dilution). A comparison is shown for c) Sample A to d) an extrapolated Sample B as a representative reading for a sample without dilution.

# Extended Exposure Results

- Sample A (no dilution)

Exposure Duration	Average Potency	General Assessment	Odor Descriptions	Effects Descriptions
0	0.2	NI, N	foam cutter	None
1	0.6	NI, N	foam cutter, plastic	None
3	0.4	NI, N	plastic	None
6	0.6	NI, N	glue	None
9	0.4	NI, N	sweet, glue	None
12	0.2	NI, N	sweet	None
15	0	NI, N	None	None
25	0	NI, N	None	None
30	0	NI, N	None	None

**General Assessment:** Non Irritating (NI), Neutral (N), Pleasant (P), Irritating (I), Revolting (R)

**Potency Scale:** No Odor (0), Slightly Detectable (1), Easily Detectable (2), Very Detectable (3), Extremely Detectable (4)

# Extended Exposure Results

- Sample B (~4/5 dilution 24-hours prior to testing)

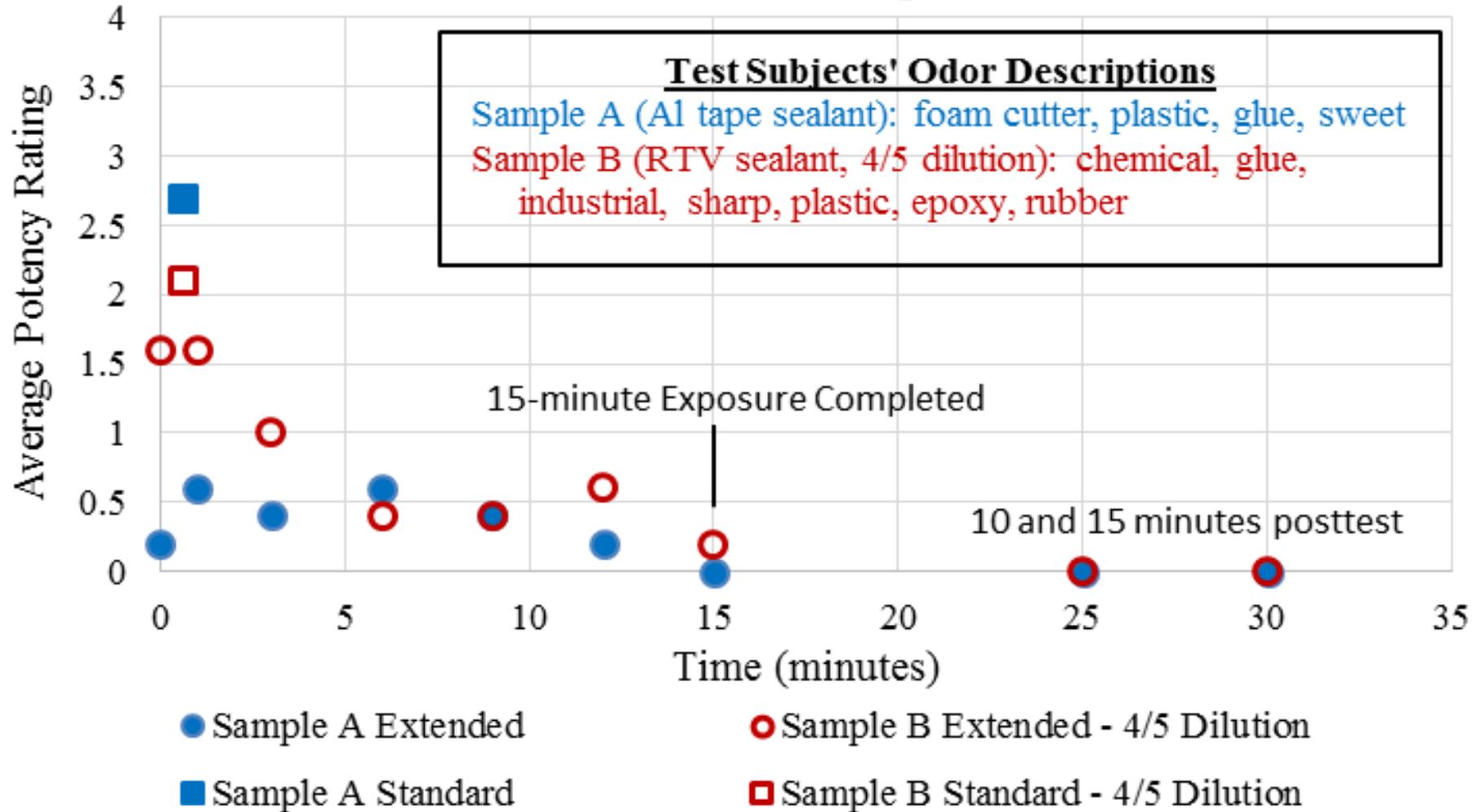
Exposure Duration	Average Potency	General Assessment	Odor Descriptions	Effects Descriptions
0	1.6	NI, N, I	chemical, model airplane glue, glue, industrial, sharp	None
1	1.6	NI, N, I	chemical, model airplane glue, ball pit, glue, sharp	None
3	1	NI, N, I	chemical, model airplane glue, glue, plastic	None
6	0.4	NI, N	industrial, epoxy	None
9	0.4	NI, N	industrial, epoxy, rubber mat	None
12	0.6	NI, N, I	glue	None
15	0.2	NI, N	None	None
25	0	NI, N	None	None
30	0	NI, N	None	None

**General Assessment:** Non Irritating (NI), Neutral (N), Pleasant (P), Irritating (I), Revolting (R)

**Potency Scale:** No Odor (0), Slightly Detectable (1), Easily Detectable (2), Very Detectable (3), Extremely Detectable (4)

# Consolidated Odor Testing Results

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# Conclusions

- Extended-duration odor testing with 15 min exposures proved to be an effective tool for
  - Realistically simulating odor exposures
  - Assessing extended-duration exposure effects of materials with known odor concerns
  - Adequately assessing long-term and physical effects that may arise out of odor exposure
  - Evaluating how these effects vary after the exposure has ended.

# Odor Test Options

- All odor testing is optional per NASA-STD-6001
- NASA-STD-6001 supplemental Standard Test 6 is effective and conservative in its assessment of material odors
- If a preferred material is confirmed to have an odor of concern, the test methodology for Extended Exposure is recommended
- Odor Containment Testing can be performed in conjunction with both Standard and Extended Exposure odor tests
- Comparative Odor Testing methods can be applied to Standard, Extended Exposure or Odor Containment testing