Test 6, Test 7, and Gas Standard Analysis Results Data Compiled by NASA Johnson Space Center White Sands Test Facility

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Agenda

Statistical Analysis Definitions

Odor Analysis Results,
NASA Standard 6001 Test 6

Toxic Offgassing Analysis Results,
NASA Standard 6001 Test 7

Gas Standard Results,
NASA Standard 6001 Test 7

Discussion

Areas of Concern

Statistical Analysis Definitions

Statistics Reported

- Standard Deviation

$$S = \sqrt{\frac{\sum_{i=1}^{N} X_i^2 - \frac{\left(\sum_{i=1}^{N} X_i\right)^2}{N}}{N-1}}$$

- % Relative Standard Deviation (%RSD)

$$\%RSD = \frac{S}{\overline{X}} \times 100\%$$

- Relative Percent Difference (RPD)

$$RPD = \frac{\left(\left|X_1 - X_2\right|\right)}{\overline{X}} \times 100$$

Odor Analysis Results

Odor Round Robin Participants

- JAXA
- NASA WSTF

Odor Analysis Results

Odor Round Robin Sample for 2004

04-38703, Aluminized Mylar

Sample Selection by NASA WSTF

Odor Analysis Results

04-38703, Aluminized Mylar Odor Rating

Center	Average Odor Value	RPD
NASDA (1/10 dilution)	0.2	--
NASA (1/10 dilution)	0.8	30
NASDA (no dilution)	0.8	--
NASA (no dilution)	1.0	18.0

Toxic Offgassing Analysis Results

Round Robin Participants

- JAXA
- NASA JSC
- NASA MSFC
- NASA WSTF

Toxic Offgassing Analysis Results

JAXA Intra-laboratory Comparison

- 12 out of 49 offgassed compounds were not detected in all five tests of the film
  - 11 of the 12 compounds were < 0.5 µg when detected
  - these 12 compounds are not included in the statistical analysis
- 6 out of 37 consistently detected compounds yielded a %RSD > 50% for the five tests of the film
- 31 out of 37 consistently detected compounds yielded a %RSD < 50% for the five tests of the film

Toxic Offgassing Analysis Results

JAXA Intra-laboratory Comparison

T-Value Calculation Used for JAXA Results

$$T = \sum_{n=1}^{k} \frac{\mu g_n}{TL_n}$$

Where:

μg_n = micrograms of compound n

TL_n= Toxic Limit (µg) for compound n

TL = SMAC (mg/m^3) X 65000

SMAC (ppm) Conversion = 0.4089 = 22.4 L/mole X (298/273)

- T value for 2 out of the 5 tests of the film was 0.001
- T value for 2 other films out of the 5 tests of the film was 0.0008
- T value for 1 out of the 5 tests of the film was 0.0006

Toxic Offgassing Analysis Results JSC Intra-Laboratory Comparison

- 47 out of 55 reported offgassed compounds were reported as Trace
  - 39 of the 47 Trace reported compounds were consistently reported as Trace
  - 8 of the 47 Trace reported compounds were not reported as Trace in all five tests of the film
  - the 47 compounds reported as Trace were not included in the statistical analysis
- 50 out of 55 reported offgassed compounds were consistently reported as Trace or a µg quantity in all five tests of the film
  - 8 out of 55 consistently reported compounds reported µg quantities
  - the 8 compounds with reported µg quantities yielded a % RSD < 50 for the five tests of the film

Toxic Offgassing Analysis Results JSC Intra-Laboratory Comparison

T-Value calculation and values provided by JSC

$$T = \sum_{n=1}^{k} \frac{\frac{\mu g_n \times 0.001}{100}}{SMAC_n \times MW_n \times 0.4089}$$

Where:

μg_n = micrograms of compound n

$SMAC_n$= Toxic Limit (mg/m^3) for compound n

MW_n = Molecular Weight for Compound n

100 = Volume of Space Hum Module

0.001 = 1mg/1000 µg

SMAC (ppm) Conversion = 0.4089 = 22.4 L/mole X (298/273)

- T value for 4 out of the 5 tests of the film was 0.0004
- T value for the other test of the film was 0.0005

Toxic Offgassing Analysis Results MSFC Intra-laboratory Comparison

- 15 out of 29 reported offgassed compounds were reported as Trace
  - 8 of the 15 Trace reported compounds were consistently reported as Trace
  - 7 of the 47 Trace reported compounds were not reported as Trace in all five tests of the film
  - the 29 compounds reported as Trace were not included in the statistical analysis
- 22 out of 29 reported offgassed compounds were consistently reported as Trace or as µg quantity in all five tests of the film
  - 14 out of 22 consistently reported compounds reported µg quantities
  - 13 out of the 14 consistently reported compounds with reported µg quantities yielded a % RSD < 50 % for the five tests of the film
  - 1 out of the 14 consistently reported compounds with reported µg quantities yielded a % RSD > 50 % for the five tests of the film

Toxic Offgassing Analysis Results MSFC Intra-laboratory Comparison

T-Values calculation used for MSFC results

$$T = \sum_{n=1}^{k} \frac{\mu g_n}{TL_n}$$

Where:

μg_n = micrograms of compound n

TL_n= Toxic Limit (ug) for compound n

TL = SMAC (mg/m^3) X 65000

SMAC (ppm) Conversion = 0.4089 = 22.4 L/mole X (298/273)

- T value for 4 out of the 5 tests of the film was 0.05
- T value for the other test of the film was 0.04

Toxic Offgassing Analysis Results MSFC Intra-laboratory Comparison

T-Values calculation used for MSFC results substituting the high concentration unidentified component with 2,2-dimethoxypropane

$$T = \sum_{n=1}^{k} \frac{\mu g_n}{TL_n}$$

Where:

μg_n = micrograms of compound n

TL_n= Toxic Limit (ug) for compound n

TL = SMAC (mg/m^3) X 65000

SMAC (ppm) Conversion = 0.4089 = 22.4 L/mole X (298/273)

- T value for 3 out of the 5 tests of the film was 0.0008
- T value for 1 of the other tests of the film was 0.001
- T value for 1 of the other tests of the film was 0.0007

Toxic Offgassing Analysis Results WSTF Intra-laboratory Comparison

- 29 out of 39 reported offgassed compounds were consistently reported with a µg quantity in all five tests of the film
  - 6 out of the 29 consistently reported compounds with reported µg quantities yielded a % RSD > 50 % for the five tests of the film
  - 23 out of the 29 consistently reported compounds with reported µg quantities yielded a % RSD < 50 % for the five tests of the film

Toxic Offgassing Analysis Results WSTF Intra-laboratory Comparison

T-Values calculation used for WSTF results

$$T = \sum_{n=1}^{k} \frac{\mu g_n}{TL_n}$$

Where:

μg_n = micrograms of compound n

TL_n= Toxic Limit (ug) for compound n

TL = SMAC (mg/m^3) X 65000

65000 = 65 m^3 Shuttle X 1000 (µg/1mg)

- T value for 4 out of the 5 tests of the film was 0.002
- T value for the other test of the film was 0.003