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TEST REPORT

TSL No. R18047

Fire Performance Assessment for Smoke and Toxic Fume Emission.

CONDITIONS OF ISSUE OF REPORTS.

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1. INTRODUCTION

Sample specimen of coated concrete slabs were submitted on 13th December 2005, by Mr Alan Hill of E Wood Limited, for smoke emission and toxic fume emission testing, in accordance with London Underground Limited Engineering Standard 2-01001-002: Issue A1: December 2003.

2. MATERIAL DESCRIPTION

40mm thick concrete slabs coating on once face with grey flooring compound, referenced 'Floor-tech XF.

Laboratory sample reference is TSL0255

3. TEST METHOD

3.1 SMOKE EMISSION

The above specimen was tested for smoke emission on 18th December 2005, in accordance with BS6853: 1999: D8.6 – "Code of Practice for Fire Precautions in the design and construction of passenger carrying trains".

3.2 TOXIC FUME EMISSION

3.2.1 QUALITATIVE ANALYSIS

The above specimen was tested on 15th December 2005, for qualitative analysis using scanning electron microscopy and energy dispersive X-Rays.

3.2.2 QUANTITATIVE ANALYSIS

The above specimen was tested on 22nd December 2005, for quantitative determination of Nitrogen, Carbon and Sulphur using Carlo Erba EA1108 Elemental analyser'.

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4. RESULTS

The tests relate to the behaviour of test specimens of the products under particular conditions of test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use. In particular, differences in the thickness, orientation or design may significantly affect fire performance and care should be taken to ensure that any differences between the test conditions and application conditions are not adversely significant.

4.1 SMOKE EMISSION

%Transmission (100 I_t / I_o) against time was measured.

The measured absorbance A_m is calculated in accordance with the Beer-Lambert Law as follows:

$$A_m = \log_{10} (I_o / I_t)$$

Where: I_o = Initial Luminous intensity
I_t = transmitted Luminous intensity

A_m is converted to Standard absorbance A_o (Figures 1-3; Pages 10-11), using the equation:

$$A_o = (A_m \times V) / (n \times L)$$

Where: V = volume of the cube ($27m^3$)
L = optical path length (3m)
N = is the number of units comprising the specimen.

The calculated results are as follows:

Sample Reference	Test	Result Ao abs (m^2/m^2)
TSL0255	1	53.521
	2	51.402
	Average	52.462
	S.D.	1.4984

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REQUIREMENTS:

The requirements for smoke emission as stated in the London Underground Limited Engineering Standard 2-01001-002: Issue A1: December 2003 for category ST/SU/s & TU/SU/s are *A_o(abs) < 350 m^2/ m^2 and A_o(abs) < 250 m^2/ m^2 respectively.*

The test data show that the material referenced 'Floor-tech XF' meets the smoke emission criteria.

4.2 TOXIC FUME EMISSION

4.2.1 QUALITATIVE ANALYSIS

The qualitative analysis of the sample shows the following elements (Figure 4; Page 12)

Sample reference	Elements detected
TSL0255/1	Carbon, Oxygen, Aluminium, Silicon, Potassium, Barium.

4.2.2 QUANTITATIVE ANALYSIS

Sample reference	% Nitrogen	% Carbon	% Sulphur
TSL0255/1	6.39	45.30	1.56

The above results are expressed as a percentage wt/wt.

REQUIREMENTS

The Engineering Standard states that “For unrestricted use of a material, covered by Standard 2-01001-002: Issue A1: December 2003, neither it nor its constituents shall have deliberately incorporated by selection, addition or modification any significant amounts of organically bound halogens, nitrogen, sulphur or phosphorus; typical chemical groups proscribed are:-

C-X (where X = Halogen)
C-N
C-P
C-O-P
C-S
C-O-S

Trace levels of such chemical groups are acceptable – the criterion for “trace level” shall be that the summation of the weight for weight percentage of the chemical group divided by the atomic weight for the group shall not exceed 0.015”.

Thus, applying the ‘Trace level’ i.e.

$$\sum \frac{w/w\%\ of\ \ Chemical\ Group}{Atomic\ weight\ of\ \ Group} \leq 0.015$$

The calculated value for the specimen gives a value of 0.505, based on the presence of 6.39% and 1.56% Nitrogen content.

5. CONCLUSION

The material described in Section 2.0 of this report fails to meet the toxic fume emission requirements for Category *ST/SU/s “Station/Surface/supine”* of the London Underground Limited Engineering Standard 2-01001-002: Issue A1: December 2003, but meets the smoke emission requirements.

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OBSERVATIONS

SAMPLE REFERENCE TSL0255

TEST 1.

Time (min-sec)	Observations
0.00 – 40.00	Nothing significant was observed

TEST 2.

Time (min.sec)	Observations
0.00 – 40.00	Nothing significant was observed

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Figure 1: Variation of Absorbance (Ao) with time of Two specimens

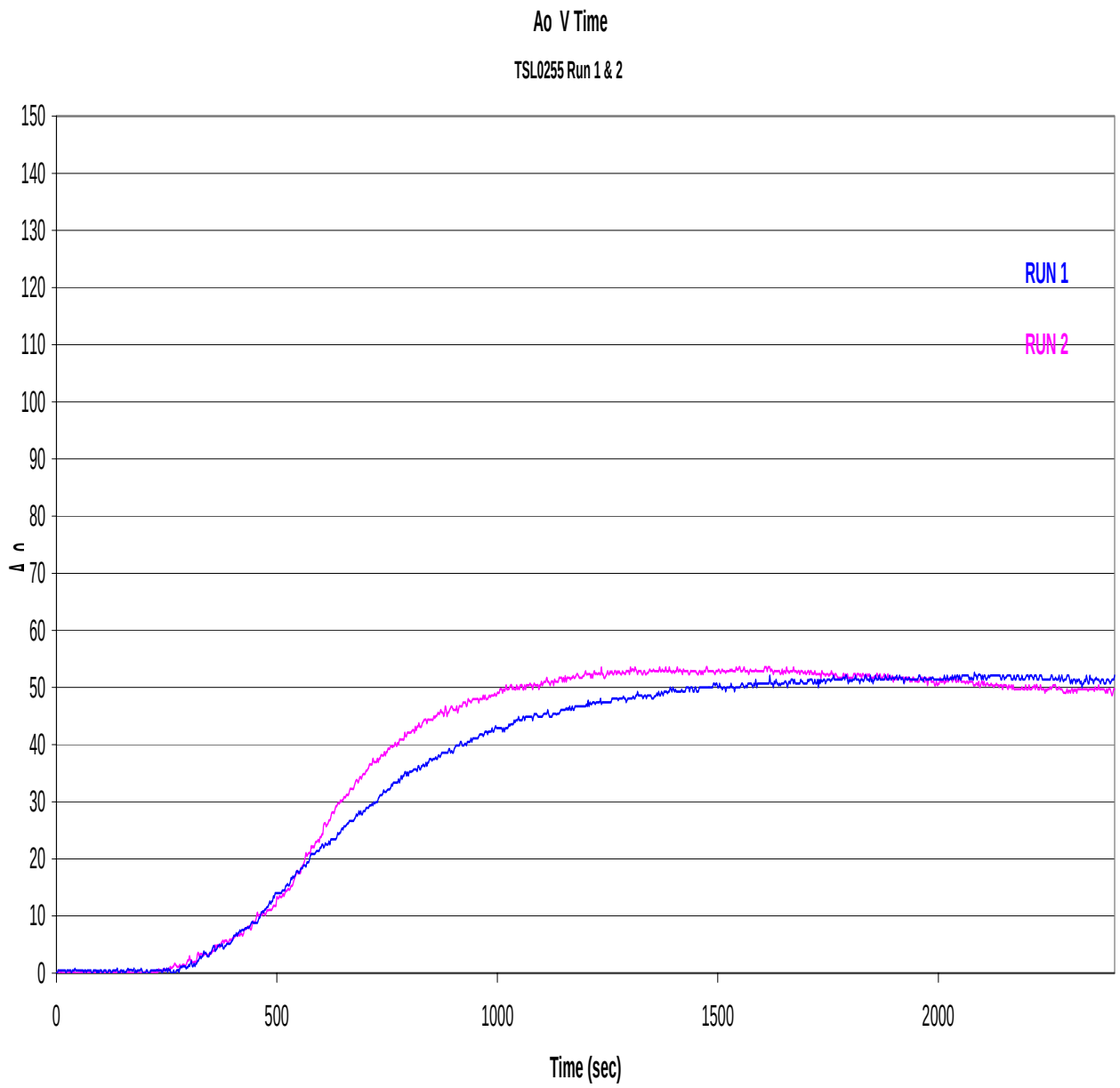

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Figure 2: Variation of Absorbance (Ao) with time (specimen No: 1)

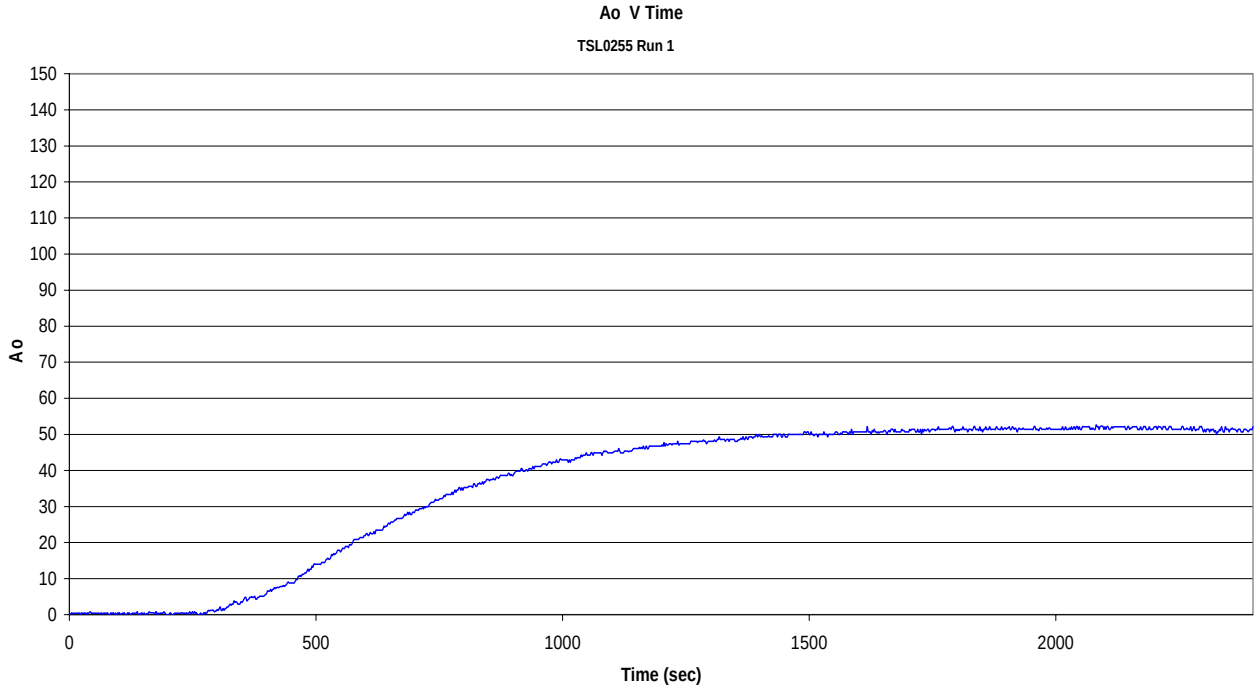

Figure 3: Variation of Absorbance (Ao) with time (specimen No: 2)

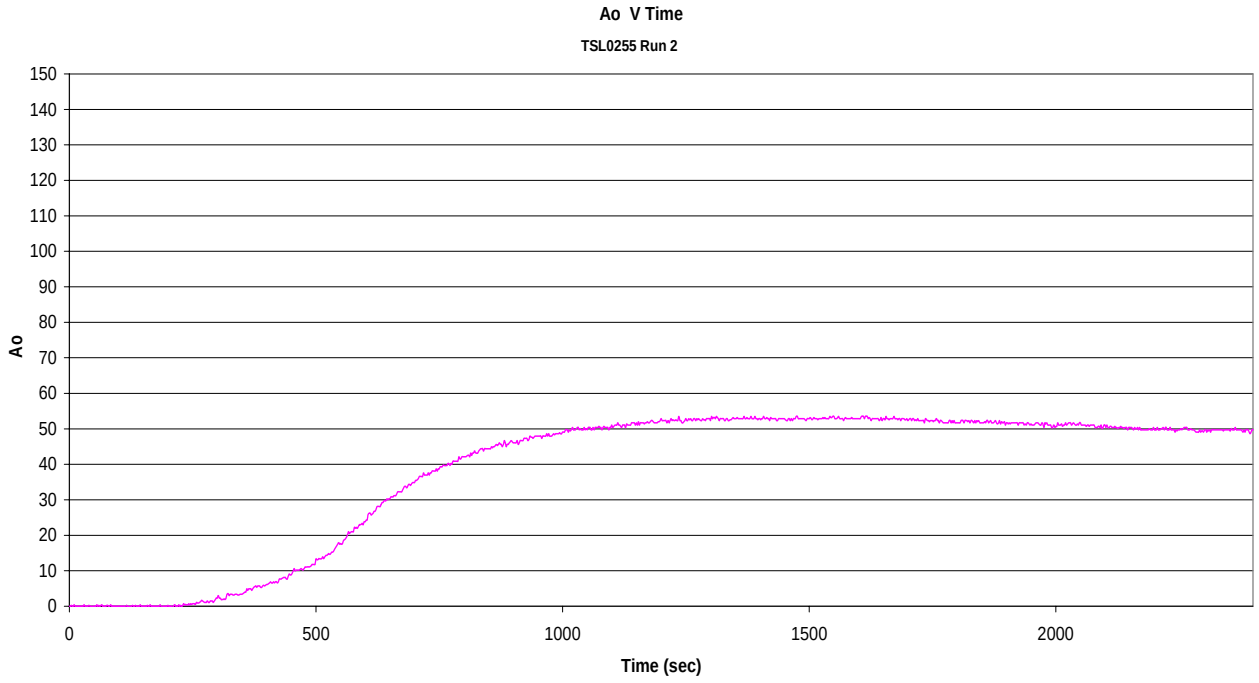

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Figure 4: X-ray spectrum for "Floor-tech XF' flooring compound.

Laboratory sample reference TSL0255/1