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FIRE PERFORMANCE EVALUATION OF "F-WMG" IN ACCORDANCE WITH NFPA 259-98, *STANDARD TEST METHOD FOR POTENTIAL HEAT OF BUILDING MATERIALS*

FINAL REPORT
Consisting of 6 Pages

SwRI® Project No. 01.11737.01.004
February 2006

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EXECUTIVE SUMMARY

Yoder & Sons, LLC, located in Greer, South Carolina, submitted a material identified as "F-WMG," for testing in accordance with National Fire Protection Association (NFPA) 259-98, *Standard Test Method for Potential Heat of Building Materials*. Tests were conducted on November 1, 2005, and January 12 and 13, 2006, at Southwest Research Institute's (SwRI) Department of Fire Technology, located in San Antonio, Texas.

Because SwRI was unable to combust the material provided by Yoder & Sons, LLC, the potential heat of combustion could not be determined, therefore; it was estimated to be 0 BTU/lb.

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1.0 INTRODUCTION

The objective of this test program was to perform a fire performance evaluation for Yoder & Sons, LLC, located in Greer, South Carolina. The material, identified by the client as "F-WMG," was tested in accordance with National Fire Protection Association (NFPA) Standard 259-98, *Standard Test Method for Potential Heat of Building Materials*. Testing was conducted on November 1, 2005 and January 12 and 13, 2006, at Southwest Research Institute's (SwRI) Department of Fire Technology, located in San Antonio, Texas.

This test method is intended to measure and describe the properties of materials or products in response to heat and flame under controlled laboratory conditions. The results of this test may be used as elements of a complete fire hazard assessment or a fire risk assessment, which takes into account all the factors that are pertinent to an assessment of the fire hazard or fire risk of a particular end-use. The results apply specifically to the specimens tested, in the manner tested, and not to similar materials, nor to the performance when used in combination with other materials.

2.0 NFPA 259 TEST DESCRIPTION

2.1 Test Procedure

The gross and net calorific potential of materials are determined as described in NFPA 259-98. The apparatus, specimen preparation, and test protocol are described in detail in this standard. There are two test procedures used in this standard to determine the potential heat of a material. The first procedure is the oxygen bomb calorimeter test procedure.

A specimen weighing nominally 1.0 grams is placed in a porcelain crucible, which is then placed in a stainless steel bomb with combustion promoter. The sample is tested in general accordance with ASTM D 3286, *Test Method for Gross Calorific Value of Solid Fuel by the Isoperibol Bomb Calorimeter*. This procedure yields a gross heat of combustion. Two tests are conducted for repeatability. If the first two tests do not agree to within 10 percent, a third test is performed.

The second test procedure, the electric muffle furnace test procedure, requires a test specimen cut in the shape of a rectangular prism measuring 13 mm wide by 19 mm long by 64 mm high to be placed on the wire specimen holder, which is placed in the specimen container. The specimen container has a cap on one end, and a hole to allow fresh air to circulate around the test sample to promote complete combustion.

The test sample is exposed to furnace conditions (750 ± 10°C) for 2 hours with a regulated airflow supplied at 47 cm^3/sec referenced to 20°C and 101 kPa, *i.e.*, standard temperature and

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The test sample is exposed to furnace conditions (750 ± 10°C) for 2 hours with a regulated airflow supplied at 47 cm^3/sec referenced to 20°C and 101 kPa, *i.e.*, standard temperature and

pressure. After 2 hours, the test sample is removed from the furnace and placed in a desiccator to cool. Once the specimen has cooled to room temperature, the mass is measured.

If the mass of the residue remaining after the electric muffle furnace test procedure is not more than 5 percent of the initial mass of the test specimen, then the gross heat of combustion measured in the oxygen bomb calorimeter test procedure is considered to be the potential heat of the material tested.

If the mass of the residue is greater than 5 percent of the initial mass of the test specimen, then the residue must be tested according to the oxygen bomb calorimeter test procedure. Two tests must be performed. If the results from the first two tests differ by more than 10 percent, a third test is performed. The potential heat of the material is the difference between the gross heat of combustion measured in the first test procedure and the gross heat of combustion of the residue (as defined in NFPA 259) from the second procedure.

2.2 Measured Parameters

Gross Heat of Combustion (Q_{gr}) – The amount of heat released by the complete combustion of a unit of mass of the material, corrected for the heats of formation of H_2NO_3 and H_2SO_4, and for the heat of combustion of the firing wire and combustion promoter (if required). The gross calorific potential has a different value when combustion occurs in a constant pressure environment from that obtained in a constant volume environment. Tests are performed in a constant volume.

Potential Heat (Q_p) – The difference between the gross heat of combustion per unit mass of a representative specimen of the material and the heat of combustion per unit mass of any residue remaining after exposure of a representative specimen of the material to a defined heat source (*i.e.*, muffle furnace) using combustion calorimetric techniques.

3.0 DESCRIPTION OF TEST SPECIMENS

Yoder & Sons, LLC, located in Greer, South Carolina, provided a material for testing in accordance with NFPA 259. The material was identified by the client as "F-WMG," trade name "Flex-C-Ment Wall Mix Grey." The material was grey in color. The material was described by the Client as "proprietary cementicious material." A pre-cured 12- × 12- × 4-in. block of the material was received at SwRI on September 19, 2005.

SwRI personnel prepared specimens for bomb calorimeter testing in accordance with NFPA 259. The sample was ground to a fine powder, and then made into a pellet. Samples were prepared using benzoic acid as a combustion promoter. For the electric muffle furnace test procedure, specimens were prepared to the appropriate dimensions per NFPA 259.

Samples were placed in a conditioned environment maintained at 23 ± 2°C and 50 ± 5% relative humidity from the time they were received until specimen preparation, and then again until just prior to testing.

4.0 TEST RESULTS

Electric muffle furnace testing was conducted on November 1, 2005. The oxygen bomb calorimetry testing was conducted on January 12 and 13, 2006. Table 1 contains the test data set from the initial bomb calorimeter test procedure, and Table 2 includes the test data from the electric muffle furnace procedure.

Table 1. NFPA Bomb Calorimeter Results on Material Identified as "F-WMG."

	Run 1	Run 2	Average	Percent Difference	Allowable Percent Difference
Gross Heat of Combustion (BTU/lb)	Unable to Combust	Unable to Combust	---	---	10 %

Table 2. NFPA 259 Electric Muffle Furnace Results on Material Identified as "F-WMG."

	Run 1	Run 2	Average
Initial Mass (g)	12.26	12.75	12.51
Final Mass (g)	10.63	11.20	10.92
Percent Residue	86.7 %	87.8 %	87.3 %
Gross Heat of Combustion[1] (BTU/lb)	Unable to Combust	Unable to Combust	---

1-Not tested when the percent residue is less than 5%.

Five attempts were made to combust the material. After each attempt, the sample would remain in the capsule while the combustion promoter was completely consumed. The residue from the electric muffle furnace test runs was combined with benzoic acid as a combustion promoter. After several attempts, we were unable to combust the residue.

Since SwRI was unable to combust the material provided by Yoder & Sons, LLC, the potential heat of combustion could not be determined; therefore, it was estimated to be 0 BTU/lb.