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TEST REPORT

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NFPA 286

STANDARD METHODS OF FIRE TESTS FOR EVALUATING CONTRIBUTION OF WALL AND CEILING INTERIOR FINISH TO ROOM FIRE GROWTH

Astro Shield II

Project No. 3101427SAT-001

August 07, 2006

Prepared for:

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ABSTRACT

This report describes the results obtained when insulation identified as **"Astro Shield II"** were tested in accordance with NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth. The test material was mounted on the RHS, LHS and rear walls as well as the ceiling of the test room. The sample did not spread flames to the ceiling during the 40 kW exposure. The flames did not spread to the extremities of the walls during the 160 kW exposure. The sample did not exhibit flashover conditions during the test. NFPA 286 does not publish pass/fail criteria. This specimen did meet the criteria set forth in the 2003 IBC Section 803.2.1

Javier O. Trevino
Senior Project Engineer

8/25/06
Date

Reviewed and approved:

Deggary N. Priest
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INTRODUCTION

This standard describes a method for determining the contribution of textile wall and ceiling coverings to room fire growth during specified fire exposure conditions. This method is not intended to evaluate the fire endurance of assemblies, nor is it able to evaluate the effect of fires originating within the wall assembly. The method is not intended for the evaluation of floor finishes.

This method is to be used to evaluate the flammability characteristics of finish wall and ceiling coverings when such materials constitute the exposed interior surfaces of buildings. This test method does not apply to fabric covered less than ceiling height, freestanding, prefabricated panel furniture systems or demountable, relocatable, full-height partitions used in open building interiors. Freestanding panel furniture systems include all freestanding panels that provide visual and/or acoustical separation and are intended to be used to divide space and may support components to form complete work stations. Demountable, relocatable, full-height partitions include demountable, relocatable, full-height partitions that fill the space between the finished floor and the finished ceiling.

This fire test measures certain fire performance characteristics of finish wall and ceiling covering materials in an enclosure under specified fire exposure conditions. It determines the extent to which the finish covering materials may contribute to fire growth in a room and the potential for fire spread beyond the room under the particular conditions simulated. The test indicates the maximum extent of fire growth in a room, the rate of heat release, and if they occur, the time to flashover and the time to flame extension beyond the doorway following flashover. It does not measure the fire growth in, or the contribution of, the room contents. Time to flashover is defined herein as either the time when the radiant flux onto the floor reaches 20 kW/m^2 or the temperature of the upper air reaches 600°C. A pair of crumpled single sheets of newspaper are placed on the floor 2 feet out from the center of the rear wall and front walls to determine flashover. The spontaneous ignition of this newspaper provides the visual indication of flashover.

The potential for spread of fire to other objects in the room, remote from the ignition source, is evaluated by measurements of:

1. The total heat flux incident on the center of the floor.
2. A characteristic upper-level gas temperature in the room.
3. Instantaneous net peak rate of heat release.

The potential for the spread of fire to objects outside the room of origin is evaluated by the measurement of the total heat release of the fire.

TEST EQUIPMENT AND INSTRUMENTATION

IGNITION SOURCE

The ignition source for the test is a gas burner with a nominal 12- by 12-inch porous top surface of a refractory material. The burner used at this laboratory is filled with a minimum 4-inch layer of Ottawa sand.

The top surface of the burner through which the gas is applied is positioned 12 inches above the floor, and the burner enclosure is located such that the edge of the diffusion surface is located 1 inch from both walls in the left corner of the room opposite from the door.

The gas supply to the burner is C.P. grade propane (99 percent purity). The burner is capable of producing a gross heat output of 40±1 for five minutes followed by a 160±5 kW for ten minutes. The flow rate is metered throughout the test. The design of the burner controls is such that when one quarter-turn ball valve is opened, the flow of gas to the burner produces 40 kW and when a second quarter-turn valve is opened the combined flow produces 160 kW.

COMPARTMENT GEOMETRY AND CONSTRUCTION

The interior dimensions of the floor of the fire room, when the specimens are in place, measures 8 feet ± 1 inch by 12 feet ± 1 inch. The finished ceiling is 8 feet ± 0.5 inches above the floor. The four walls are at right angles defining the compartment. The compartment contains a 30 ± 0.25 by 80 ± 0.25 inch doorway in the center of one of the 8- by 8-foot walls. No other openings are present to allow ventilation. The test room is lined with 5/8" type X gypsum wallboard.

TOTAL HEAT FLUX GAUGE

A gauge shall be mounted a maximum of 2 inches above the floor surface, facing upward in the geometric center of the test room. The gauge shall be of the Gardon type, with a flat black surface, and a 180-degree view angle. In operation, it shall be maintained at a constant temperature (within ± 5% °F) above the dew point by water supplied at a temperature from 120° to 150°F.

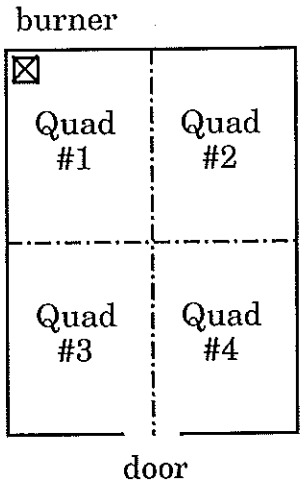
THERMOCOUPLES

Bare chromel-alumel thermocouples 20 mil in diameter (24 GA. Type K, Chromel-Alumel, Special Limits of Error: ±1.1°C, purchased with Lot Traceability and with 5-point calibrations at each end of the Lot Purchase), with electrically welded thermojunctions shall be used at each required location. The thermocouple wires, within 0.5 inches of the thermojunction, shall be run along expected isotherms to minimize conduction errors. The insulation between the wires shall be stable to at least 2 000°F or the wires shall be separated.

THERMOCOUPLE LOCATIONS

LOCATION	DESCRIPTION OF PLACEMENT
DOORWAY	A thermocouple is located in the interior plane of the door opening on the door centerline, 4 inches down from the top.
ROOM	Thermocouples are located 4 inches below the ceiling at the center of the ceiling, the center of each of the four ceiling quadrants and directly over the center of the ignition burner.
HOOD EXHAUST DUCT	One pair of thermocouples is placed in the duct 9 duct diameters downstream of the entrance to the horizontal duct.

The placement of the Quadrant Thermocouples is as shown in the drawing below. All plots and data tables follow this format.



Room Quadrant Thermocouple Locations (Plan View)

CANOPY AND EXHAUST DUCT

A hood is installed immediately adjacent to the door of the fire room. The bottom of the hood is level with the top surface of the room. The face dimensions of the hood are 15- by 15-feet, with a depth of 5 feet. The hood feeds into a plenum having a 4- by 4-foot cross section and a height of 4 feet. The exhaust duct connected to the plenum is 30 inches in diameter, horizontal, and has a circular aperture of 24 inches at its entrance.

DUCT GAS VELOCITY

A bi-directional probe is used to measure gas velocity in the duct. The probe consists of a short stainless steel cylinder 1.75 inches long and 0.875 inches inside diameter, with a solid diaphragm in the center. The pressure taps on either side of the diaphragm support the probe. The axis of the probe is along the center line of the duct, 9 duct diameters downstream from the entrance. The pressure taps are connected to a pressure transducer capable of resolving pressure differences of 0.001 inches W.C.

OXYGEN MEASUREMENTS

A stainless steel gas sampling tube is located 10 duct diameters downstream from the entrance to the duct at the geometric center of the duct ±1/2 inch to obtain a

continuously flowing sample for determining the oxygen concentration of the exhaust gas as a function of time. The oxygen content of the duct exhaust gas is determined by an oxygen analyzer with a relative accuracy of ±2% in the concentration range from 15 to 21% oxygen. The signal from the oxygen analyzer is within 5% of its final value within 30 seconds following a step change in the composition of the gas stream flowing past the sampling tube inlet.

PHOTOGRAPHIC RECORDS

Digital color photographs and DV video taping are both used to record and document the test. Care is taken to position the photographic equipment so as to not interfere with the smooth flow of air into the test room.

PROCEDURE

SUMMARY OF METHOD

A calibration test is run within 30 days of testing any material as specified in the standard. All instrumentation is zeroed, spanned and calibrated prior to testing. The specimen is installed and the diffusion burner is placed. The collection hood exhaust duct blower is turned on and an initial flow is established. The gas sampling pump is turned on and the flow rate is adjusted. When all instruments are reading steady state conditions, the computer data acquisition system and video equipment is started. Ambient data is taken then the burner is ignited at a fuel flow rate that is known to produce 40 kW of heat output. This level is maintained for five minutes at which time the fuel flow is increased to the 160 kW level for a 10-minute period. During the burn period, all temperature, heat release and heat flux data is being recorded every 6 seconds. At the end of the fifteen minute burn period, the burner is shut off and all instrument readings are stopped. Post test observations are made and this concludes the test.

All damage is documented after the test is over, using descriptions, photographs and drawings, as is appropriate.

TEST SPECIMEN

The test specimen is identified as **"Astro Shield II".** Each panel measured approximately 4 ft. wide x 8 ft. tall. Each panel was metallic in color. The panels were attached to the walls and ceiling using metal studs spaced 2 ft apart. See Photos in Appendix B for a visual depiction of the description above.

All joints and corners in the room were sealed to an airtight condition using gypsum drywall joint compound and/or ceramic fiber insulation. See photos in the appendix for a detailed view of the finished specimen.

TEST RESULTS

The test was begun at 1:20 p.m., July 25, 2006. The ambient temperature was 90°F with a relative humidity of 50%. The thermocouples and other instrumentation were positioned in accordance with the standard and their outputs verified after connection to the data acquisition system. The data acquisition system was started and allowed to collect ambient data prior to igniting the burner and establishing a gas flow equivalent to 40 kW for the first 5 minutes and 160 kW for the next 10 minutes. Events during the test are described below:

TIME (min:sec)	OBSERVATION
0:00	Ignition of the burner at a level of 40 kW.
0:30	The specimen began to wrinkle.
0:41	Flaming drops began to fall from the specimen.
0:53	The specimen ignited 1 ft. above the burner.
1:30	Flames began to reach 3 ft. above the burner.
2:40	Horizontal flame spread along the right wall reached 2 ft.
3:27	Flames on the specimen began to recede.
4:00	All flames on the specimen began to recede except flames on the floor.
5:00	Burner output increased to 160 kW.
5:10	Material began to fall. Flame spread at 2 ft.
5:35	Flame spread at 3 ft.
6:00	Flame spread at 3-4 ft. along the RHS wall.
6:40	Flames began to recede.
8:01	Flame spread along the bottom of RHS wall at 3 ft.
9:10	Flame spread along the bottom of RHS wall at 4 ft and decreasing at intersection.
12:40	No new activity.
14:00	No new activity.
15:00	Test terminated.

Post Test Observations:

The drywall was flame bleached on the RHS and rear wall approximately 2 ft. from the test corner. Along the rear wall, the specimen had melted from the test corner up to 6 ft. exposing the drywall. Melting of the material decreased as the distance from the burner increased. Along the RHS wall, the material had melted and charred approximately 9 ft from the test corner. The material on the LHS wall was melted on the upper portion of the wall. The specimen on the ceiling was completely melted away. See photos in the appendix for more detailed evidence.

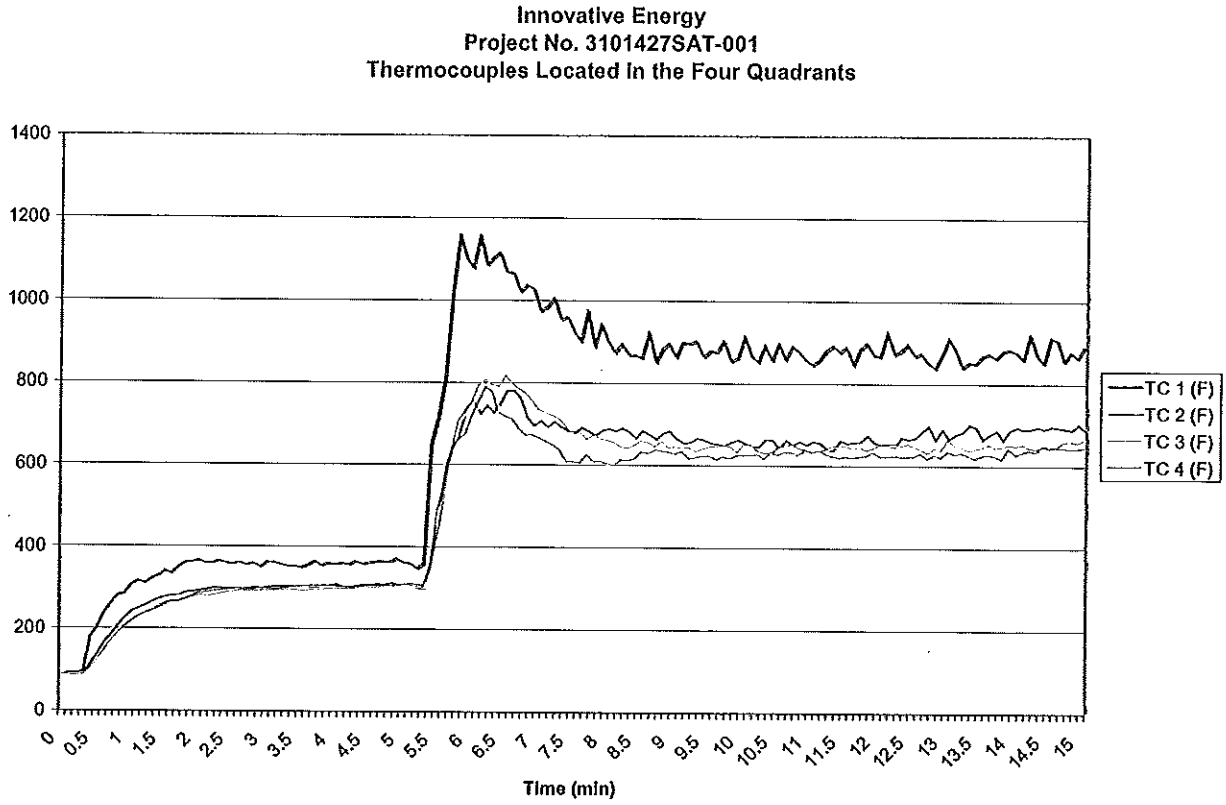
CONCLUSION

The sample submitted, installed, and tested as described in this report displayed low levels of heat release, and upper level temperatures. The sample did not spread flames to the ceiling during the 40 kW exposure. The flames did not spread to the extremities of the 12-foot walls during the 160 kW exposure. The sample did not exhibit flashover conditions during the test. NFPA 286 does not publish pass/fail criteria. One must consult the codes to determine pass fail. This specimen did meet the criteria set forth in the 2003 IBC Section 803.2.1

The test specimen identification is as provided by the client and Intertek accepts no responsibility for any inaccuracies therein. Intertek did not select the specimen and has not verified the composition, manufacturing techniques or quality assurance procedures.

APPENDIX A

DATA



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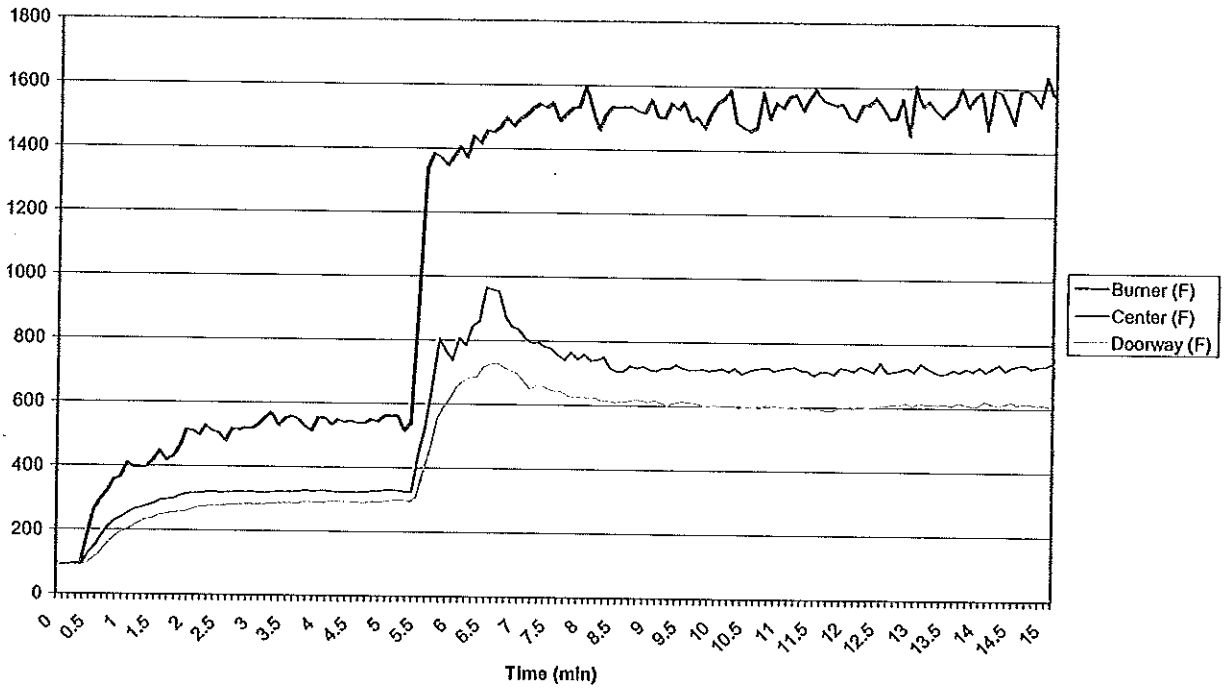
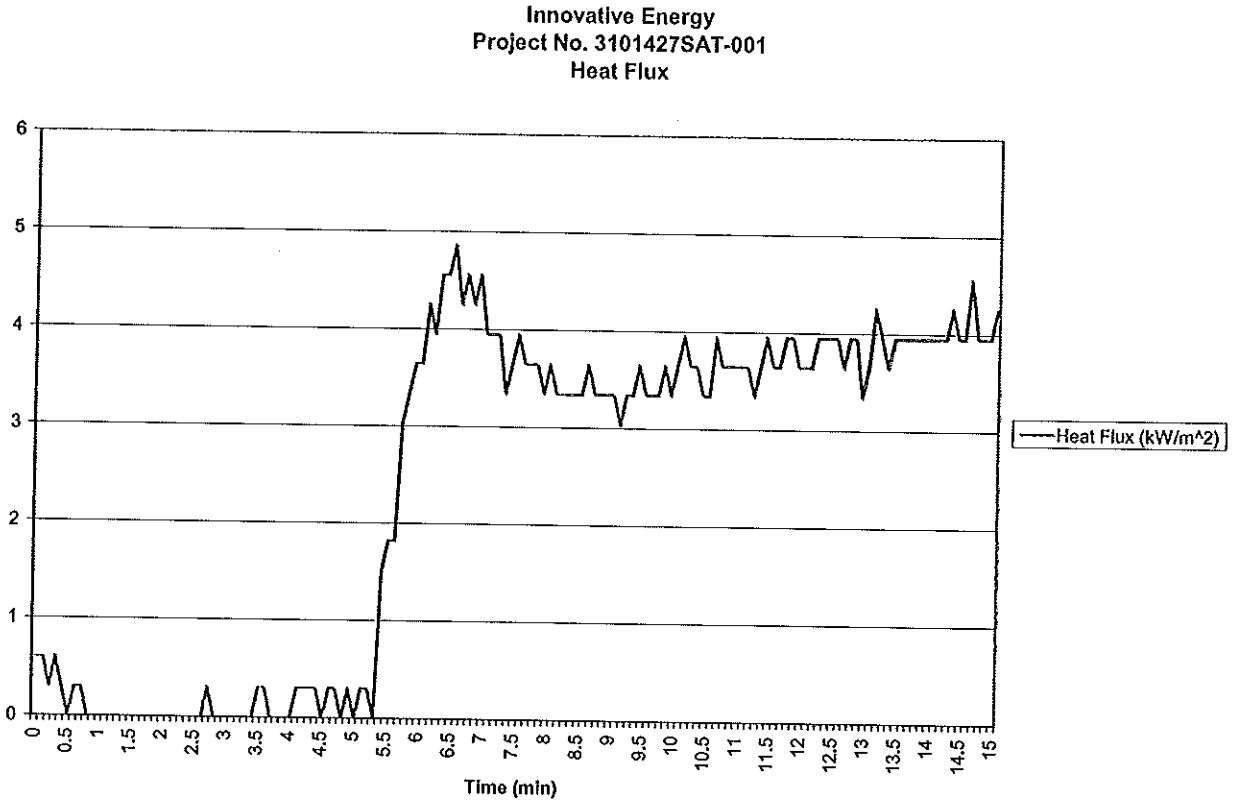
Thermocouples Located Above the Burner, In the Center, and In the Doorway





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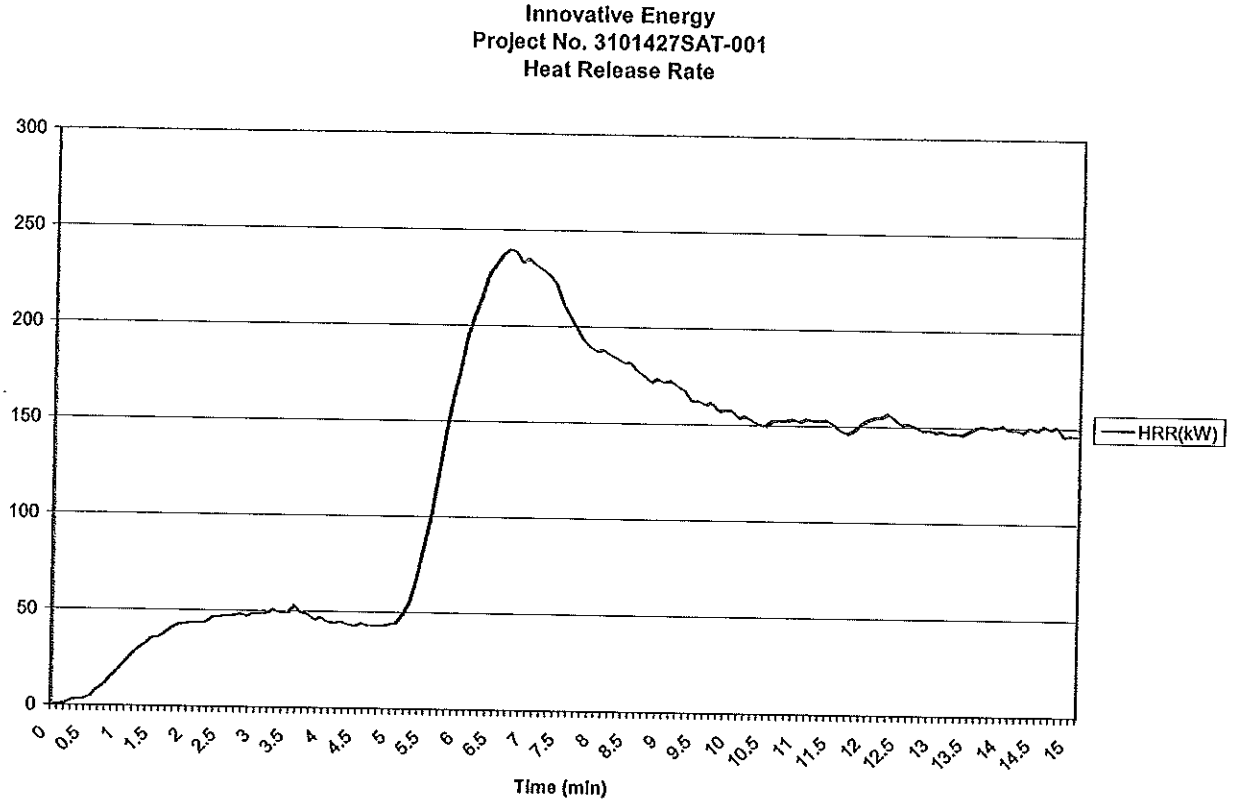
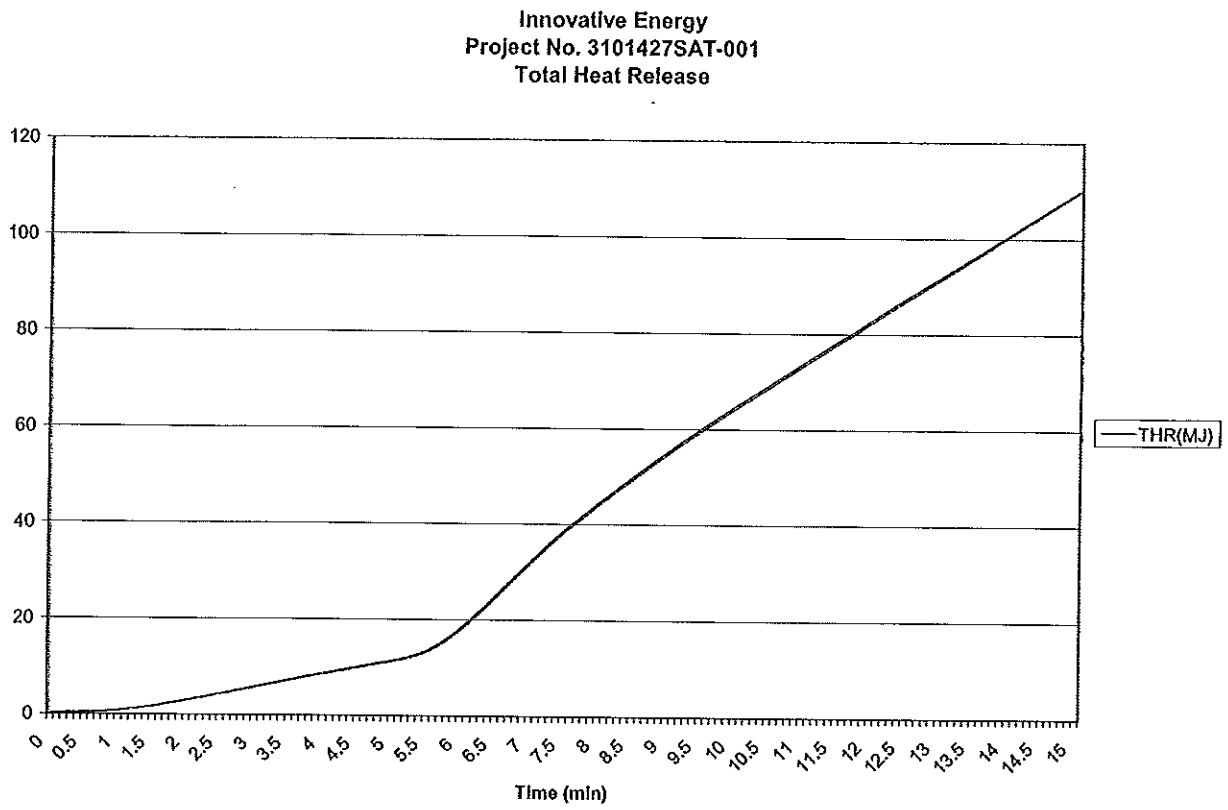
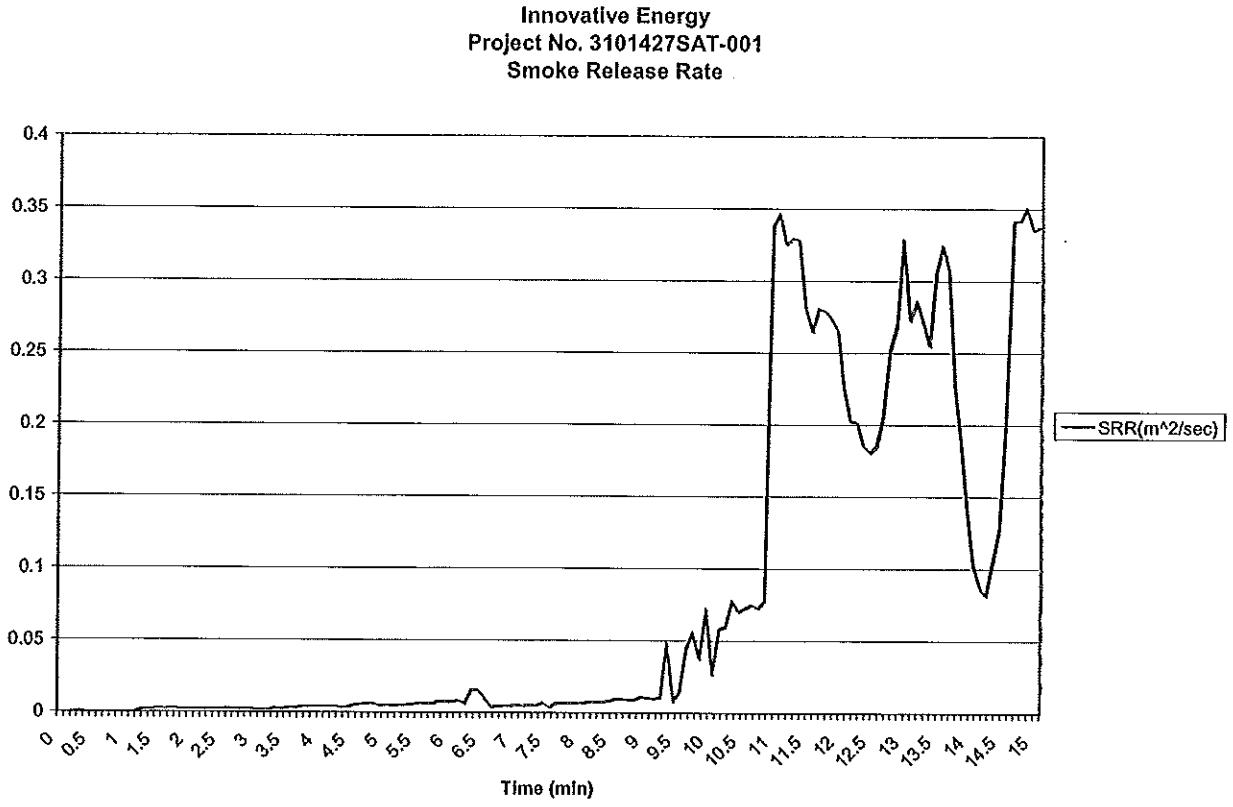
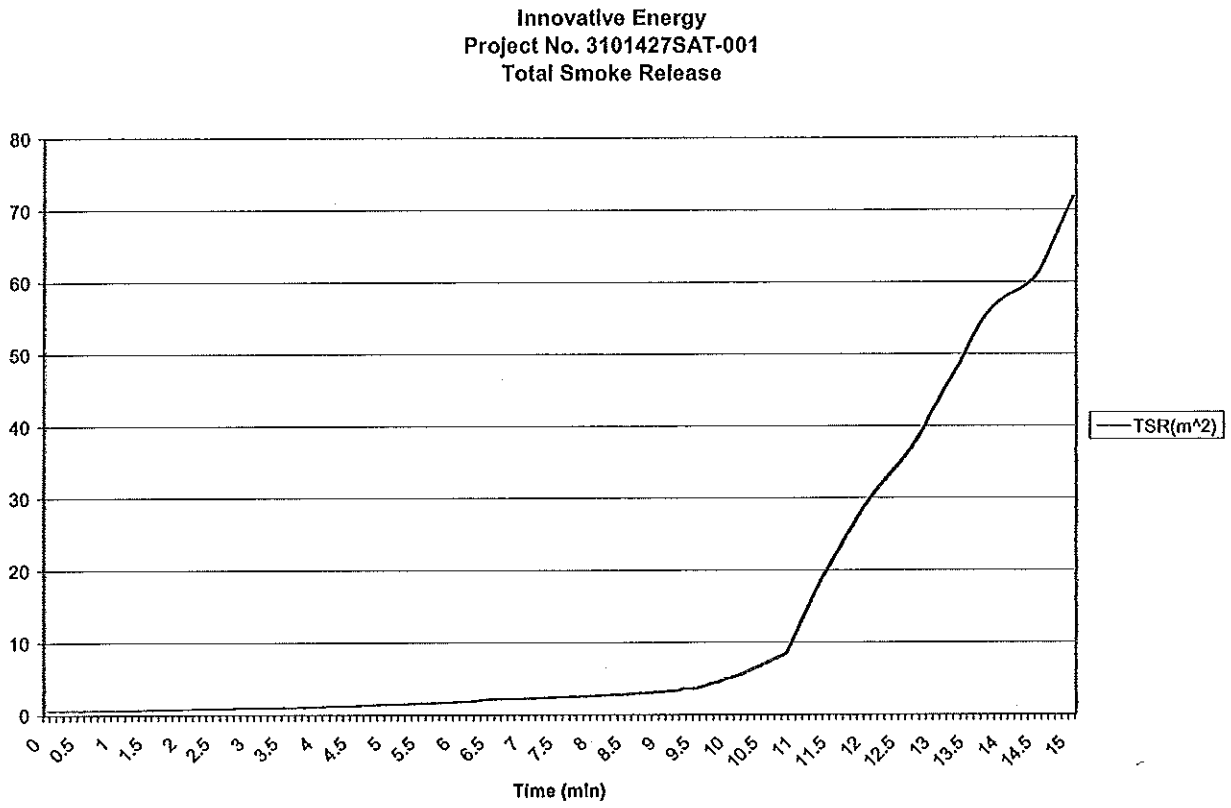

Innovative Energy
Project No. 3101427SAT-001
Heat Release Rate
300
250
200
150
100
50
0
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15
Time (min)
HRR(kW)


Innovative Energy
Project No. 3101427SAT-001
Total Heat Release
120
100
80
60
40
20
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
6
6.5
7
7.5
8
8.5
9
9.5
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15
Time (min)
THR(MJ)


Innovative Energy
Project No. 3101427SAT-001
Smoke Release Rate
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 6.5 7 7.5 8 8.5 9 9.5 10 10.5 11 11.5 12 12.5 13 13.5 14 14.5 15
Time (min)
SRR(m^2/sec)



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