



Federal Aviation
Administration

International Aircraft Materials Fire Test Working Group Meeting

Seat Flammability Test

Presented to: International Aircraft Materials Fire Test
Working Group

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Introduction

- **Seat Cushion NexGen Oil Burner Round Robin**
 - Study and Results
- **NexGen and Park Burner Comparison**
 - Small Round Robin Study and Results
- **Large and Small Test Cell Comparison**
 - Impact on Seat Test Results
- **Chapter 7 Handbook Updates**
 - Addition of NexGen Sonic Burner
 - **Availability for Certification?**
- **Future Work**



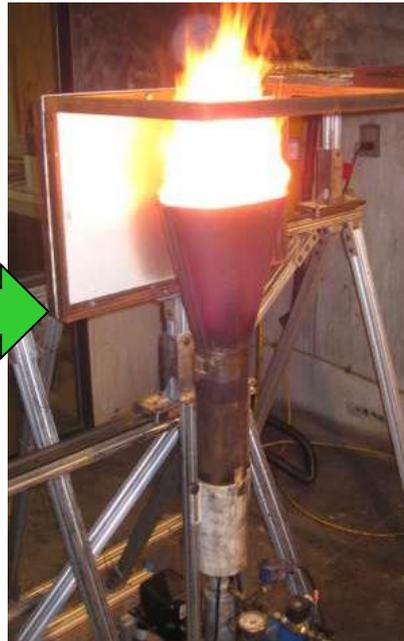
NexGen Burner Development



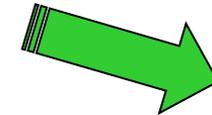
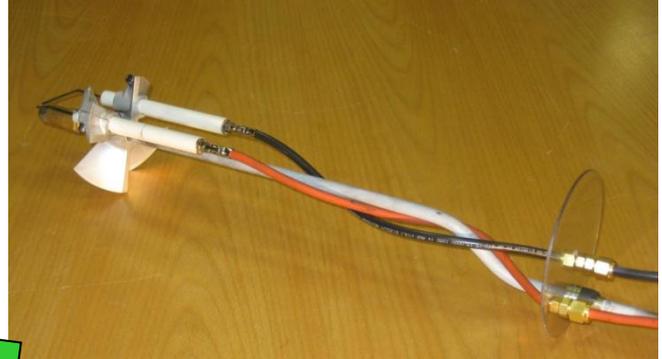
NexGen Burner Development



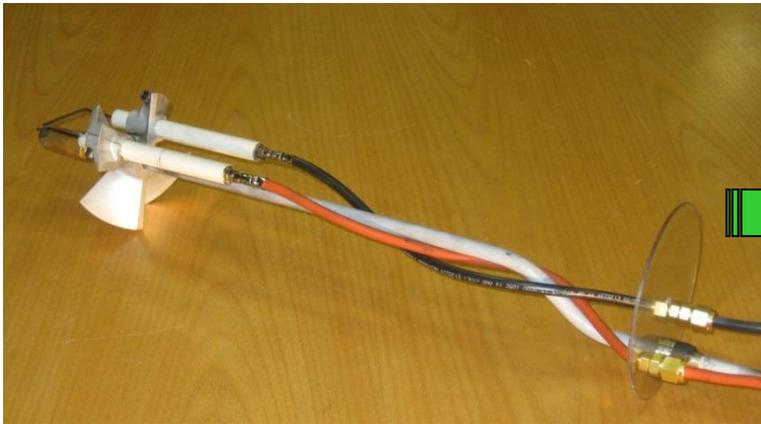
Park Burner



NexGen Burner



NexGen Burner Development



Design # 1:
Stator/Turbulator with
Internal Ignition wires
and Igniters



Design # 2:
Flame Retention Head
with Internal Ignition
wires and Igniters



Design # 3:
Igniterless Stator and
Turbulator with
External ignition Wire
and Igniter
Final Design

Seat Cushion Round Robin Study



Seat Cushion Round Robin Study

- **Purpose**

- Conduct a round robin study with the NexGen burner and igniterless configuration to demonstrate if it is an acceptable alternative to using the Park oil burner in Chapter 7 of the Handbook
- The igniterless configuration eliminates internal igniters and associated wiring to minimize airflow obstructions within the burner draft tube
- This reduces potential differences within the burner and may should lead to more repeatable results among test labs

Seat Cushion Round Robin Study

- **Round Robin Guidance**

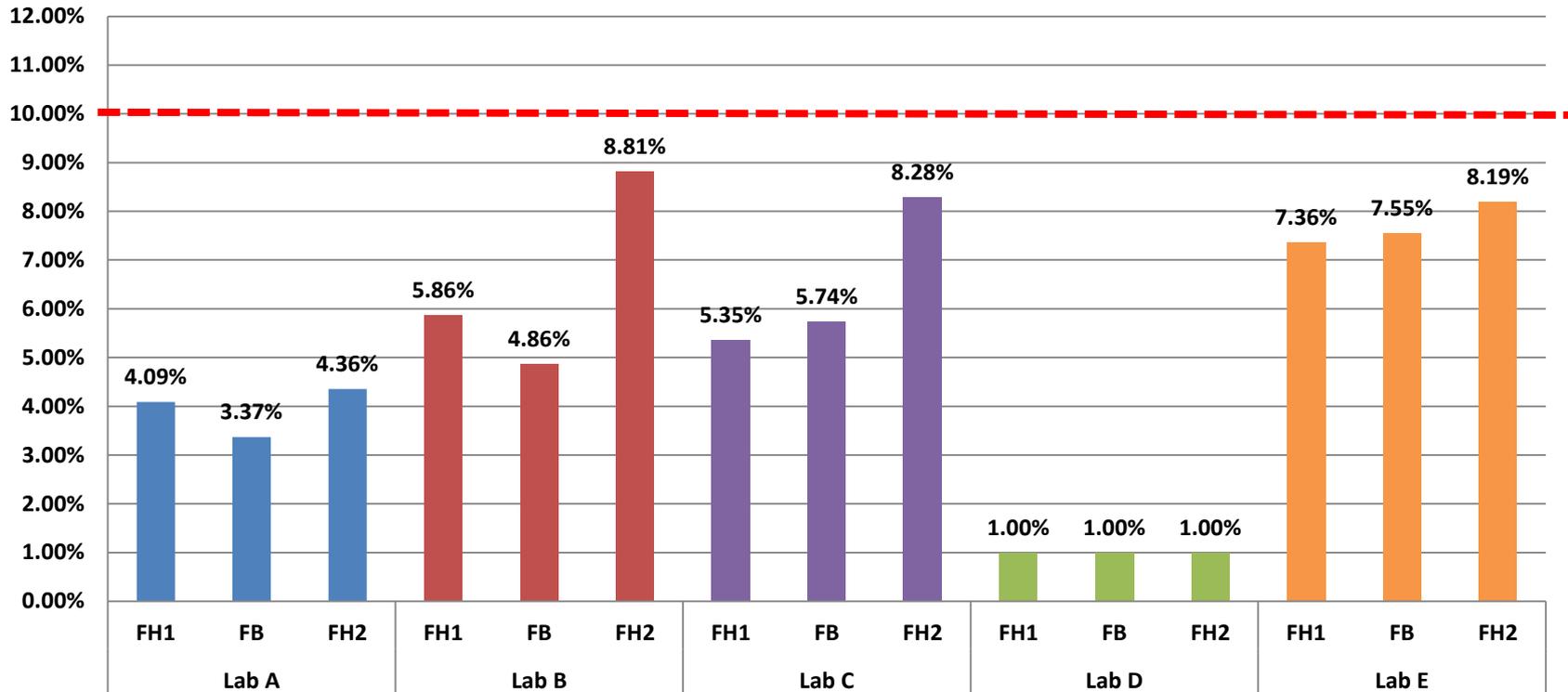
- FAA provided all labs with the same type and number of sample test materials
- All labs configured their burner using the same
- Dimensions, tolerances, and setup instructions provided by the FAA
- Test as per Chapter 7 of Handbook
- Minor differences due to use of NexGen burner
- Labs asked to include data such as fuel pressure, flame temperature check using thermocouple rake, airflow rate in test cell, etc.

Seat Cushion Round Robin Study

- **Seat Cushion Sample Materials**
 - 3 different foam types
 - 2 different fire hardened and one fireblocked
 - 3 sample sets (top and bottom) for each foam
 - 3 of each for a total of 9 sample sets
 - All seat cushions encapsulated using same fabric with hook and loop closures
 - Sample sets are the same as those used throughout all major seat cushion NexGen round robins studies conducted since 2011

Seat Cushion Round Robin Study

Average Percent Weight Loss For Each Cushion Type
(3 Samples of each Type)



FH = Fire Hardened

FB = Fireblocked

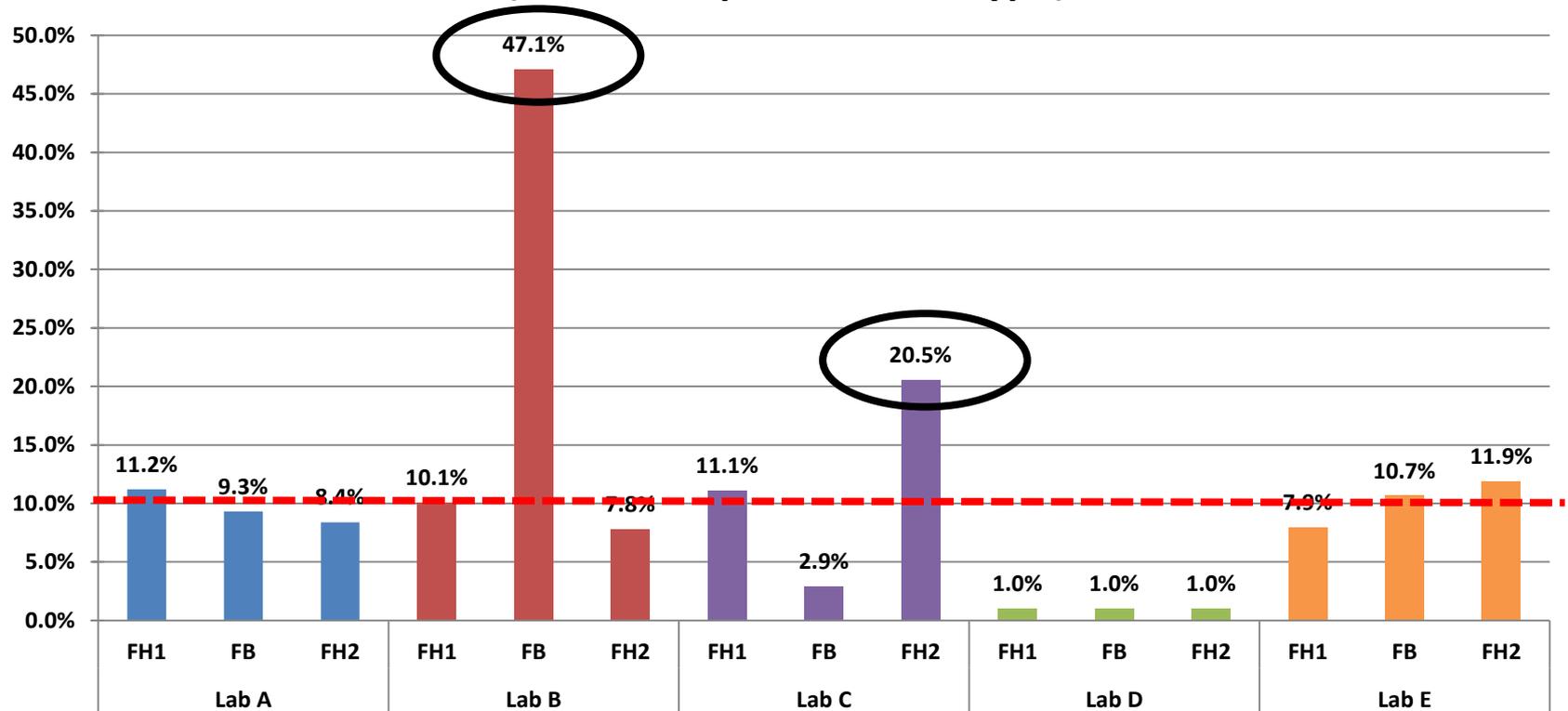
Seat Cushion Round Robin Study

- **No data was received from Lab D**
- **None of the labs had failures for average weight loss percent**
- **NexGen burner with igniterless stator proves to be an acceptable alternative to the Park burner based on results**
- **Will continue to research regarding differences in test lab results**



Seat Cushion Round Robin Study

Actual Percent Standard Deviation for Each Seat Cushion Type
(3 Seat samples for Each Type)

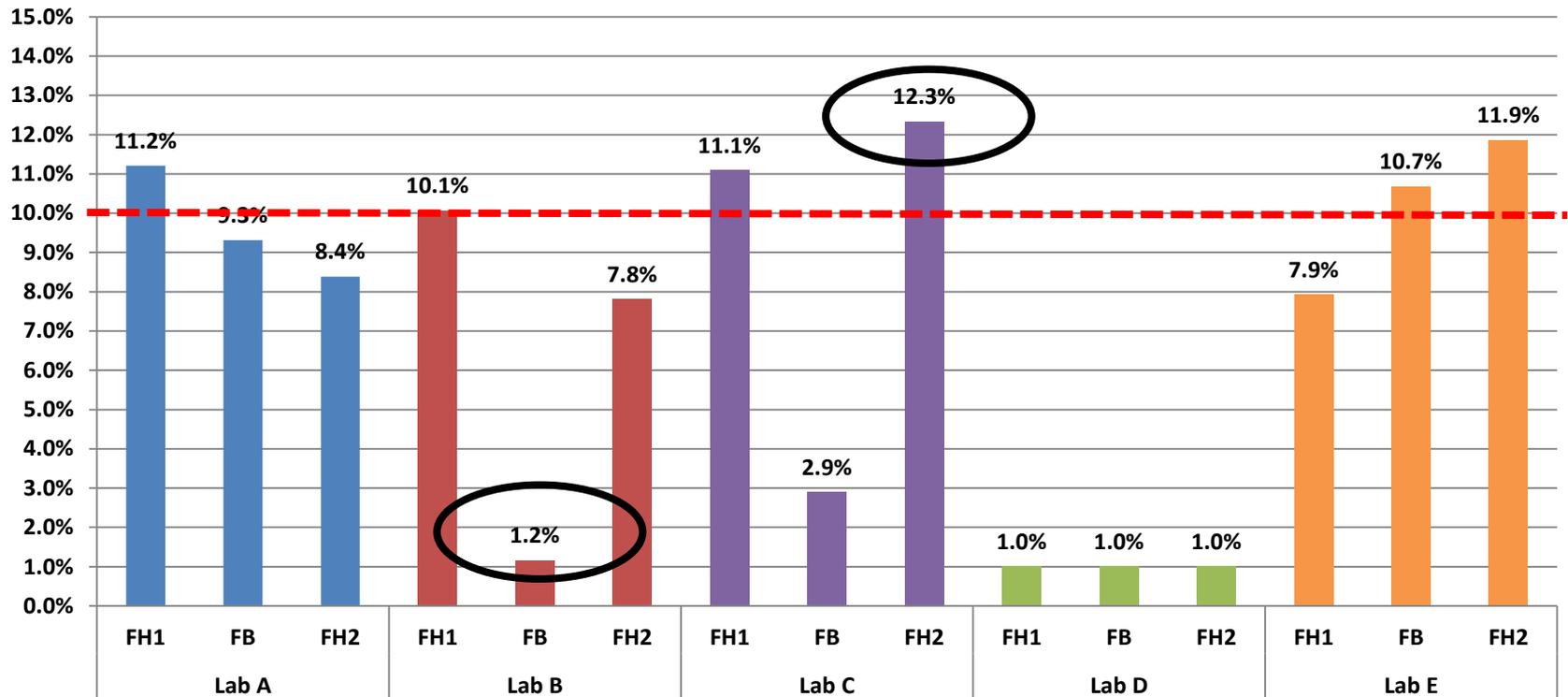


FH = Fire Hardened

FB = Fireblocked

Seat Cushion Round Robin Study

Corrected Percent Standard Deviation for Each Seat Cushion Type
(3 Seat samples for Each Type)



FH = Fire Hardened

FB = Fireblocked

Seat Cushion Round Robin Study

- **Data in corrected graph has removed a seat cushion test result that was considered to be a “rogue” sample, and does not correlate with test results from the same lab**
- **Most results fall within the acceptable 10% standard deviation limit**
- **If all burners are equal, differences in data suggest differences in test cell environment or manner in which tests were conducted**
 - Slight variations during burner construction possible

NexGen Sonic Vs. Park Burner



NexGen Sonic Vs. Park Burner

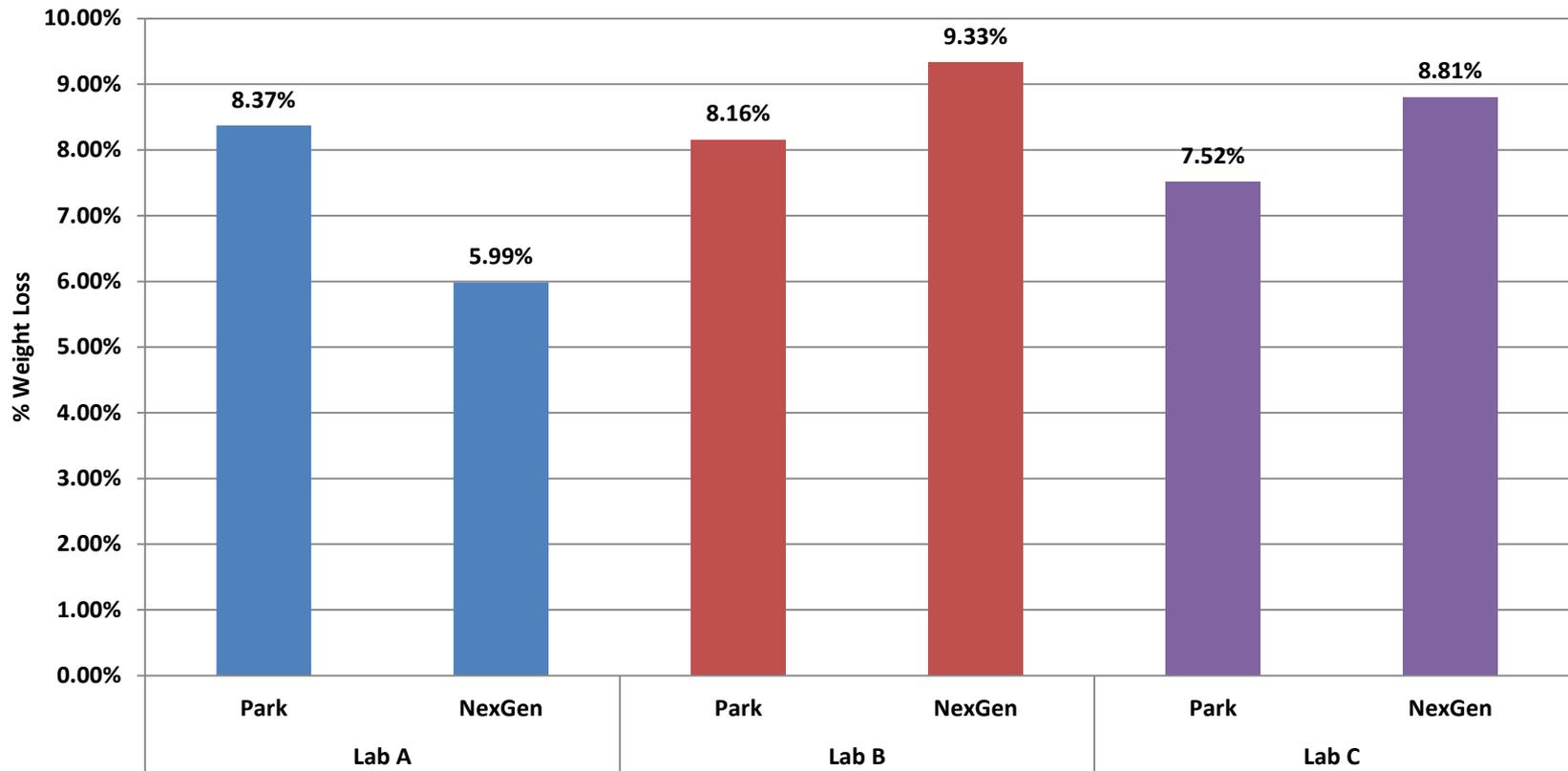
- **A small round robin study was conducted involving three labs, including the FAA**
- **Purpose was to perform a direct comparison of each lab's Park and NexGen burners**
- **Determine if the NexGen burner can produce results similar to Park burners and is an acceptable alternative**
 - Similar level of safety test standards

NexGen Sonic Vs. Park Burner

- **Park burners could be configured in anyway such that the requirements of the Handbook were met**
- **All NexGen burners configured identically**
- **Each lab provided with 4 seat cushion sample sets**
 - 2 for Park testing, 2 for NexGen testing
- **Samples constructed from the same foam type, fabric covering, and stapled closure**

NexGen Sonic Vs. Park Burner

Park vs. NexGen of Average Seat Cushion Percent Weight Loss



NexGen Sonic Vs. Park Burner

- **Slight differences in average weight loss**
- **2 labs show increased weight loss for NexGen while 1 lab show less for NexGen**
- **Number of samples tested, and only 3 labs involved, but results suggest the NexGen is relatively on par with Park burner test results**
- **Looking into reason for decreased weight loss for NexGen burner in Lab A**

Test Cell Size Comparison



Test Cell Size Comparison

- **Seat cushion testing performed in two different labs at FAA Technical Center test facility**
- **Significant differences in lab shape, size, hood design, and airflow**
- **Purpose of the study is to determine effect of test cell environment on seat cushion burner results using NexGen Burner**

Test Cell Size Comparison

- **Two different NexGen burners used**
 - Both NexGen burners configured the same
- **3 types of foam cushions in same covering**
 - 3 of each type (9 total) for each test environment
- **Test Cell #1**
 - Large (50'x26'x23), large hood, test area located in corner of cell, potential uncontrolled air draft sources
- **Test Cell #2**
 - Small (10'x10'x12'), smaller hood, close proximity walls, centered in test cell, sealed from air leaks

Test Cell Size Comparison

Small Cell (10'x10'x12')

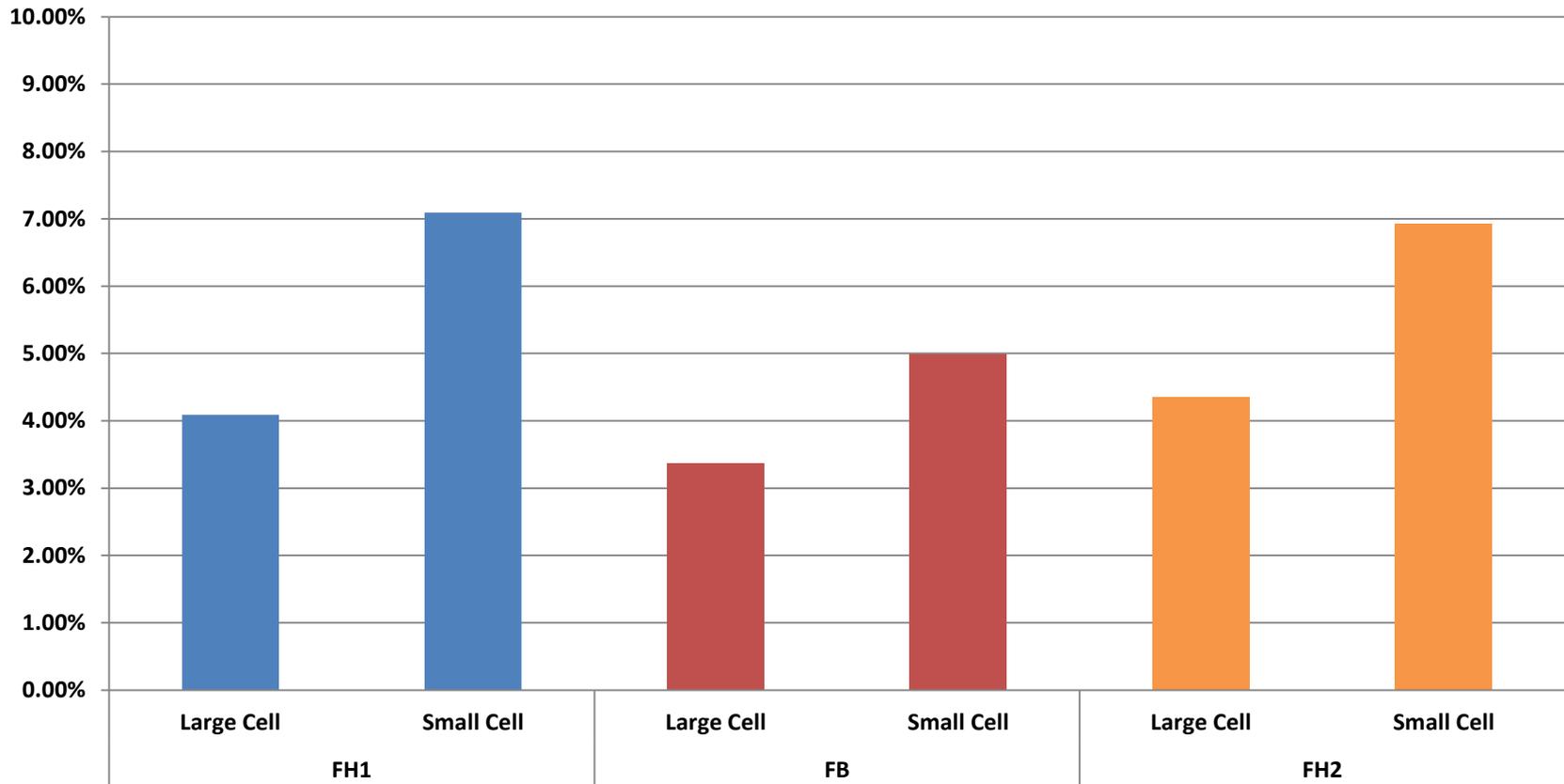


Large Cell (50'x26'x23')



Test Cell Size Comparison

Average Weight Loss Percent of Three Seat Cushion Types
in Large and Small Test Cells



Test Cell Size Comparison

- **Significantly more weight loss in small cell**
- **Reasons**
 - Heat reradiated from close proximity walls?
 - Less air movement within test cell?
 - Heat cannot dissipate as easily as in large cell?
 - Size, shape, proximity of ventilation hood?
 - Slight variations in burner components?
- **Further testing and analysis is required to determine what are the contributing factors and which have the most impact on results**

Chapter 7 Handbook Updates



Chapter 7 Handbook Updates

- **NexGen burner to be included in chapter**
- **Limited number of updated chapter copies sent out for test review**
- **Discuss during task group meeting**
 - Suggestions, corrections, concerns, additions, etc.
- **Review period for industry?**
- **When will NexGen be available for certification use?**



Future Work



Future Work

- **Continue study of test cell size environment**
 - Along with airflow study in test cell
- **Complete update of Chapter 7 in Handbook**
 - Use of NexGen burner for certification testing
- **Any items brought up during task group**

Questions?

Discuss details in task group

