HEAT RELEASE RATE Updates

2015 February Materials Meeting
Huntington Beach, CA

Materials Working Group

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February, 2015

Federal Aviation Administration

AGENDA

- Upper Pilot Burner Hot Surface Igniter
  - Review handbook document for use in today's OSU's
- HR2 / OSU
  - Test Data
  - Chapter HR Updates
- Next

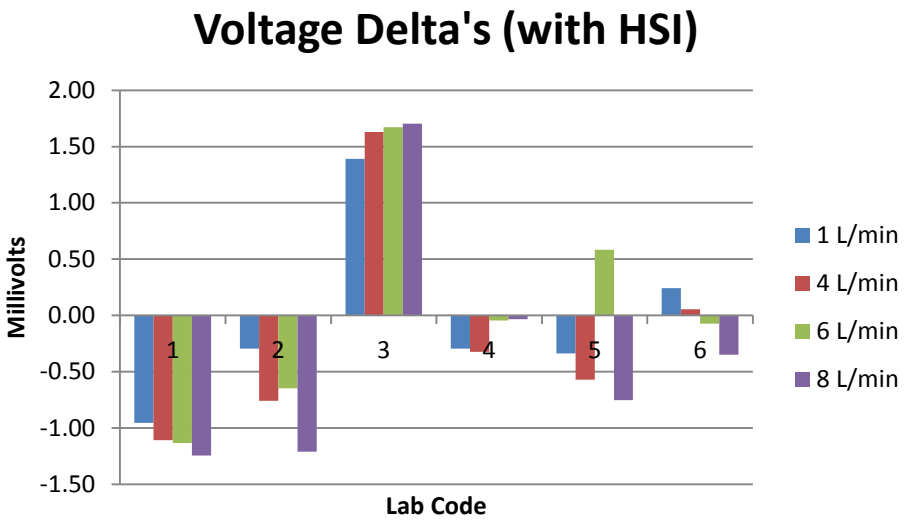
UPPER PILOT HSI (HOT SURFACE IGNITER)

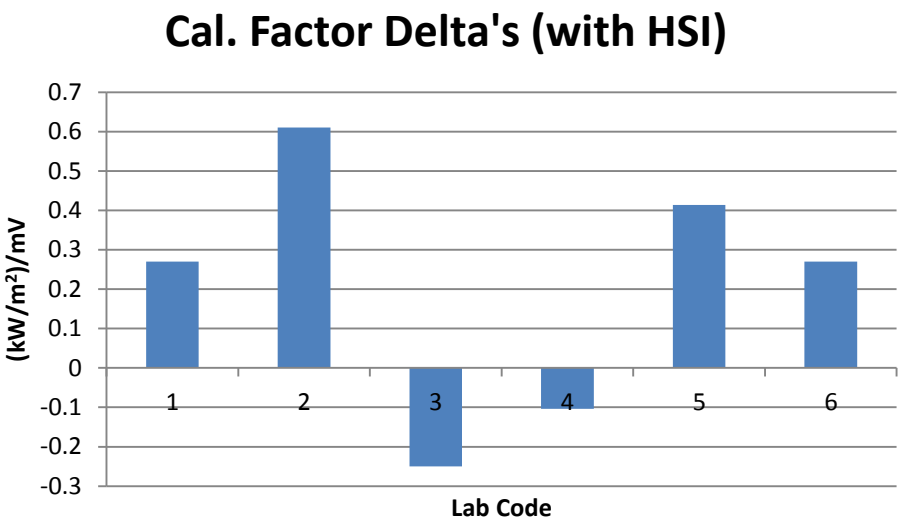
- FAA Fire Test Handbook Version (OSU)

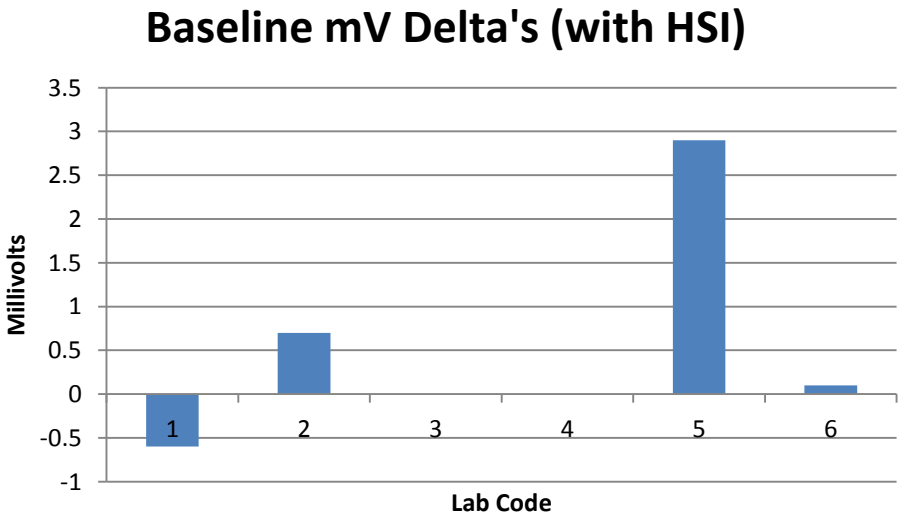
  (Most likely Placed in Supplement Bullet 5.3.8)

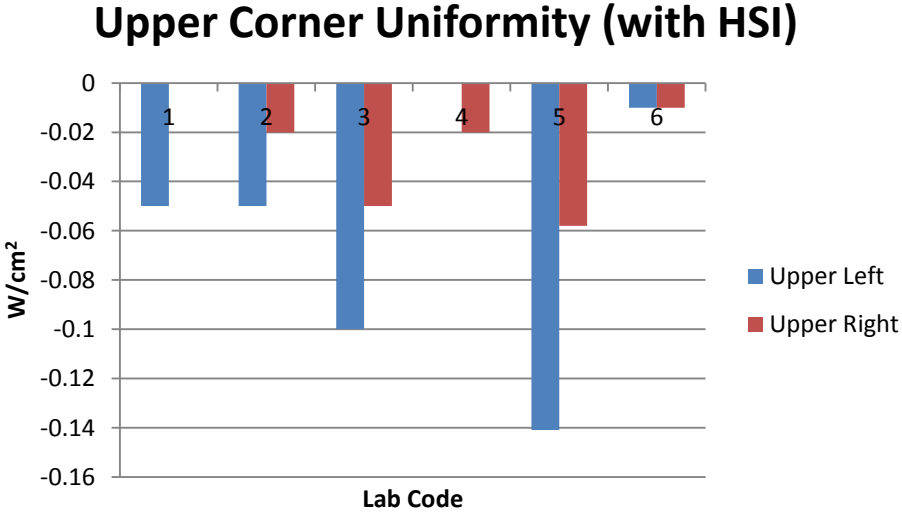
- Optional Use (Much like the Drip Pan)
- Reduce variability within OSU heat release units with regard to the performance of the upper pilot burner
- Request Task Group Input

UPPER PILOT HSI (HOT SURFACE IGNITER)









UPPER PILOT HSI (HOT SURFACE IGNITER)

- It is critical that the upper pilot burner tube is not moved out of position once set correctly.
- If the tube is inadvertently moved forward (towards the globars) there is a chance that a large portion of the upper pilot flames will go out entirely in the presence of fire retardants whereas when in the correct position only the flame tiplets will be impacted while the material is burning off.
- The difference between the two conditions could have a dramatic effect on the data.

UPPER PILOT HSI (HOT SURFACE IGNITER)

- In the event a material continues to impact the upper pilot flames even with the burner tube in the correct position an optional Hot Surface Igniter (HSI) may be installed.
- Alternatively, the HSI may be installed and used for all materials tested.
- If this device is installed, the center heat flux density and 5% uniformity requirement must be verified subsequent to a Methane gas calibration.

UPPER PILOT HSI (HOT SURFACE IGNITER)

- A 0.125 ± 0.005 inch diameter stainless steel rod 8.0 ± 0.0625 inches in length is positioned directly in the flames of the upper pilot burner.
- The rod is continuously heated by the flamelets acting as a hot surface igniter to auto-ignite any upper pilot flames should they go out.
- The distance from the centerline of the burner tube to the centerline of the HSI rod is 0.75 ± 0.125 inch.

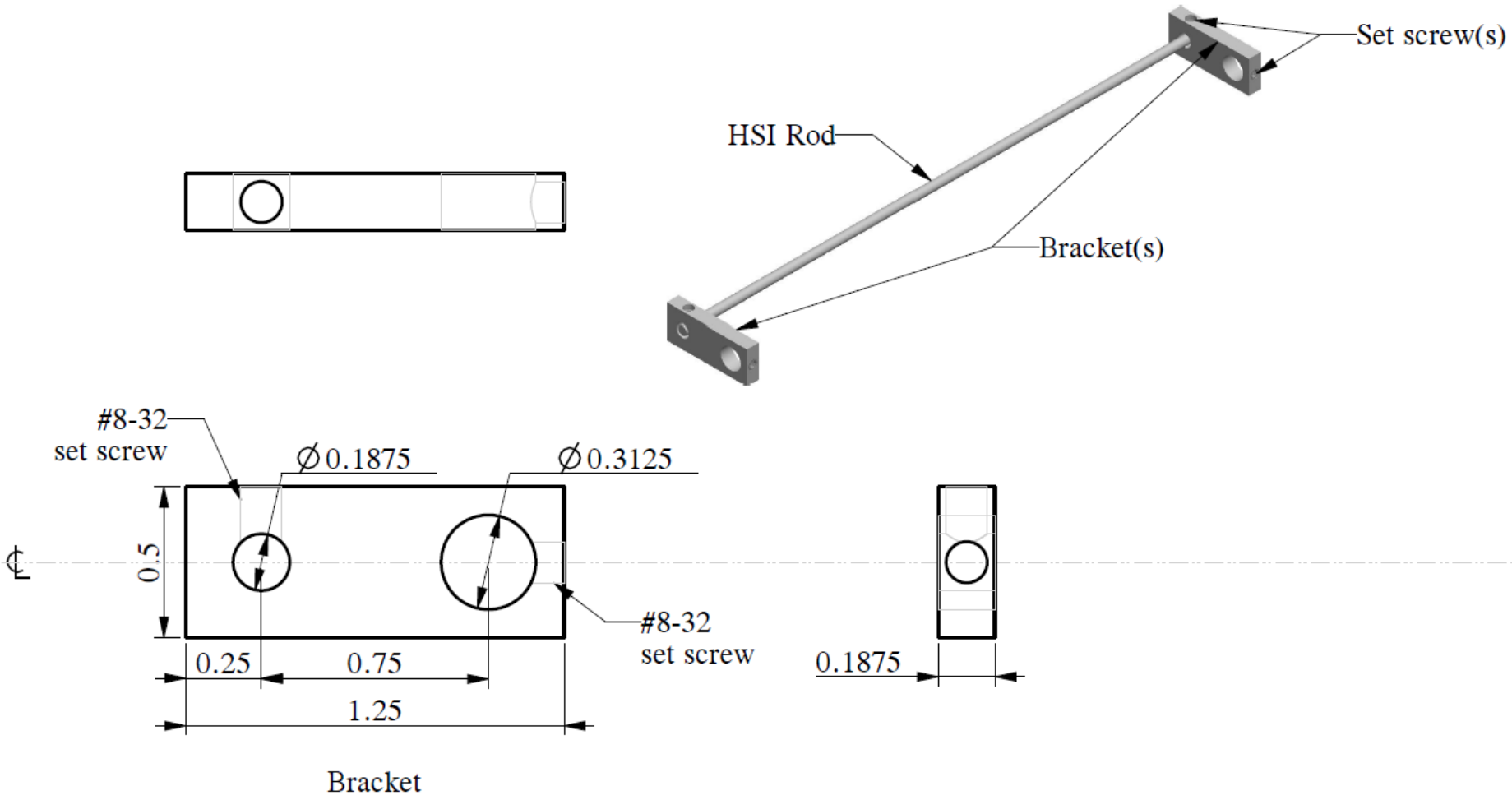
UPPER PILOT HSI (HOT SURFACE IGNITER)

- Two stainless steel support brackets are mounted on the upper pilot burner tube.
- The brackets are separated 8.0 ± 0.0625 inches from each other (outer dimension) with one bracket aligned flush with the closed end of the burner tube.
- Due to forced air flow through the chamber and convection the upper pilot flames tend to curve upward.
- To locate the HSI rod in the hottest portion of the burner flames, the brackets are rotated upward 15 ± 5° on each end (Digital Protractor).

UPPER PILOT HSI (HOT SURFACE IGNITER)

- It is not necessary for each bracket to be at the same angle provided the rod is in the direct flame path across its entire length.
- Set screws secure the rod and brackets in position.
- The HSI rod must be cleaned or replaced when showing signs of soot buildup or wear.
- Unless otherwise specified, dimensions are nominal values in inches.

UPPER PILOT HSI (HOT SURFACE IGNITER)

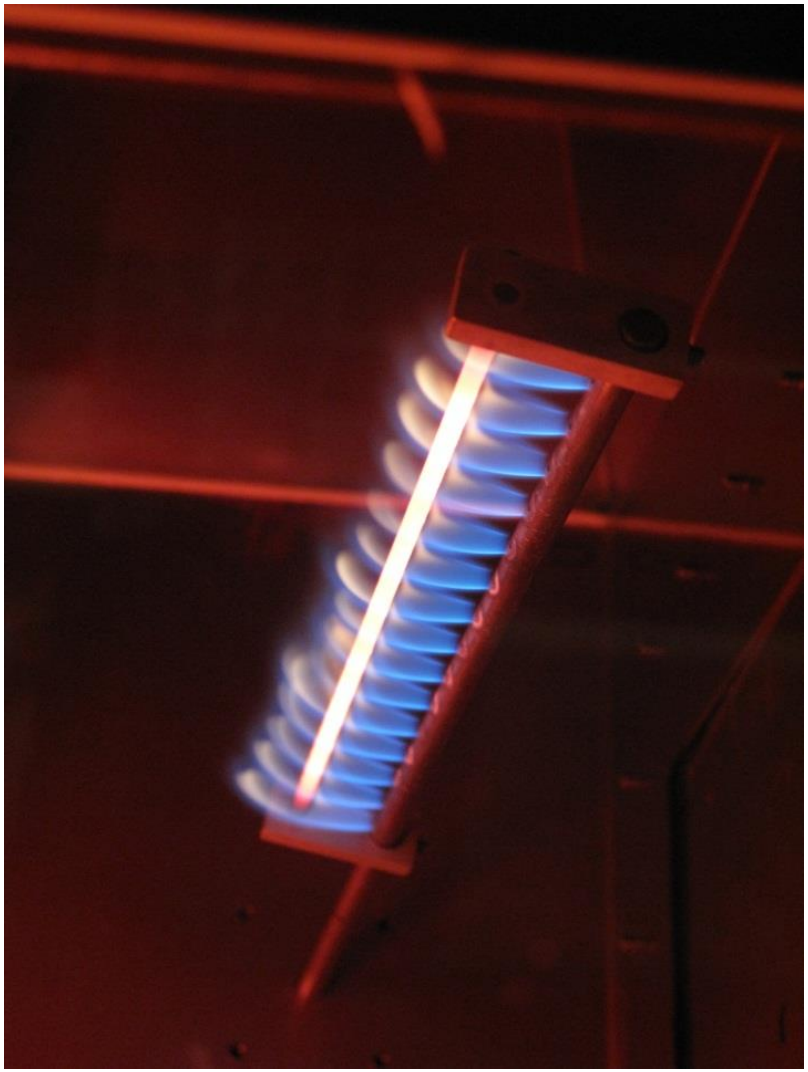


Upper Pilot Burner HSI Rod and Brackets

UPPER PILOT HSI (HOT SURFACE IGNITER)

HSI Rod and Bracket Installation

UPPER PILOT HSI (HOT SURFACE IGNITER)



HSI / Upper Pilot Burner Operation

HR2 UPDATE

CHAPTER HR UPDATES

- Added “Burr-free holes , internally and externally, but not chamfered” requirement to:
  - Upper pilot burner holes (15)
  - Lower Plate holes (8)
  - Second Stage Plate holes (120)
- Range for Valid Calibration Factor must be 0.085 +/- 0.010 kW/mV

  Removed all references to:
  - Calibration Pass/Fail Criteria (5% STDEV): This is due to difficulties in achieving this criteria now that the calibration factor is so small.
  - Calibration Factor Term: $(kW/m^2)/mv$
- Standardized use of sample holder drip pans.
  - Required for all testing regardless of whether a material drips or not
  - Optional: Permanently mounted to holder or removable

CHAPTER HR UPDATES

- For Stability (Heat Flux and Thermopile) :
  - 5% STDEV requirement was lowered to 2% STDEV (5% was too easily achieved while the system was still observed warming up).
  - Added statement that center heat flux and thermopile are calculated based on moving averages. (60 second moving average and 15 minute moving average respectively).

  <u>Center Heat flux (60 second moving average)</u>

  Heat flux gauge millivolt signal that varies less than 2.0% standard deviation over the last 60 seconds and having a calculated heat flux density that is within range.

  <u>Chamber equilibrium (15 minute moving average)</u>

  Thermopile millivolt signal that varies less than 2.0% standard deviation over the last 15 minutes commencing no sooner than 30 minutes after turning the power to the globars on.

CHAPTER HR UPDATES

- Standardized Upper/Lower Pilot Gas Flow (Flow Meter Survey)
  - Lower Pilot Flow Requirement:

    Methane: 120 ± 5 mL/min (via panel mounted flow meter)

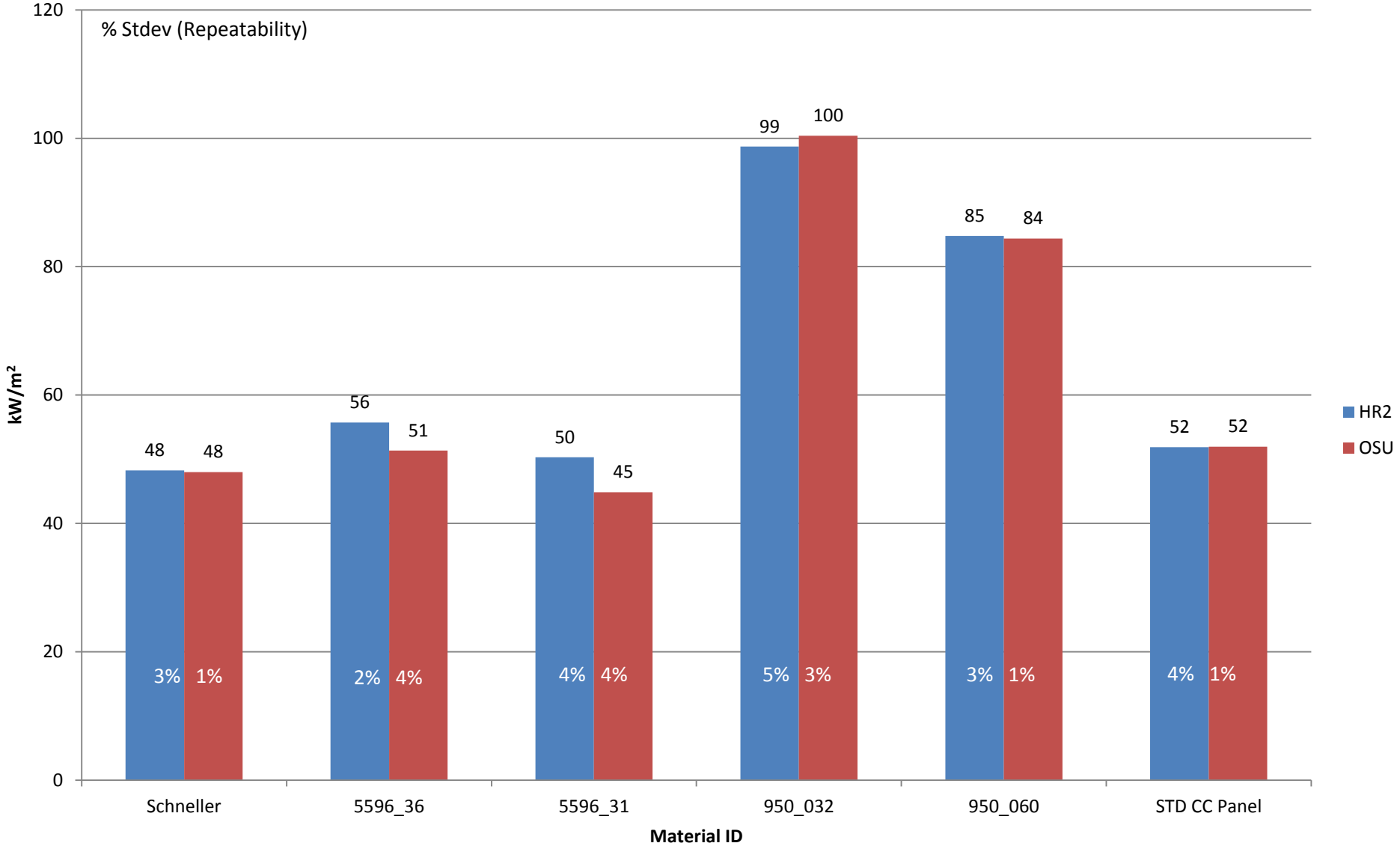
    Air: 1.0 ± 0.2 L/min (via panel mounted flow meter)
  - Upper Pilot Flow Requirement:

    Methane: 1.5 ± 0.1 L/min (via HR2 calibration MFM/MFC)

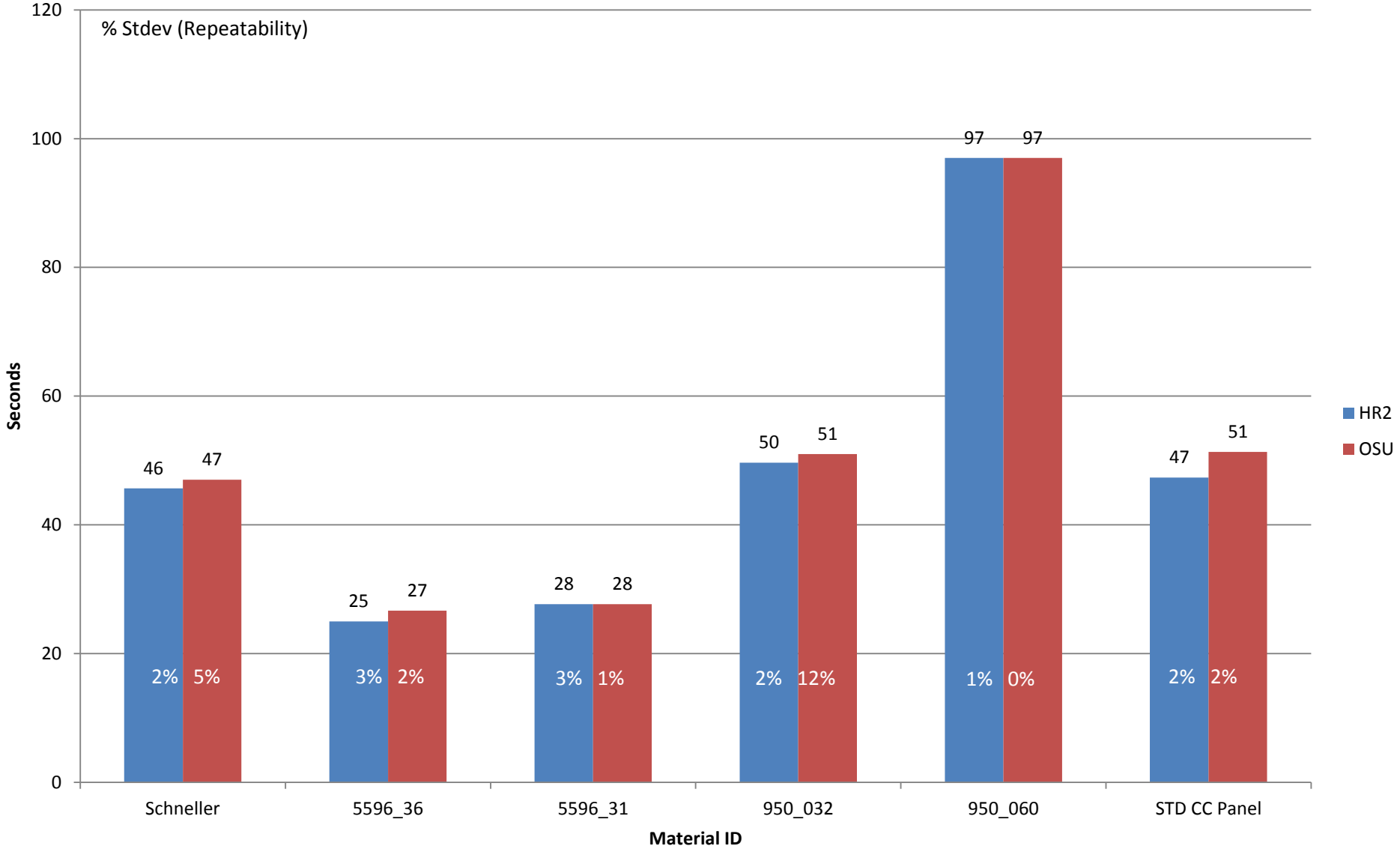
    Air: 1.0 ± 0.2 L/min (via panel mounted flow meter)

  ** All visual references in the document are aids in determining the correct flame profile but the actual flow settings must be used (Photo's added).*
- Added caution statement that since drip pans are now required, if an electronic igniter system is in place (lower pilot) it must not come in contact with the sample holder drip pan when testing.
- Increased tolerance on airflow from 20 +/- 0.5 to 20 +/- 1 SCFM

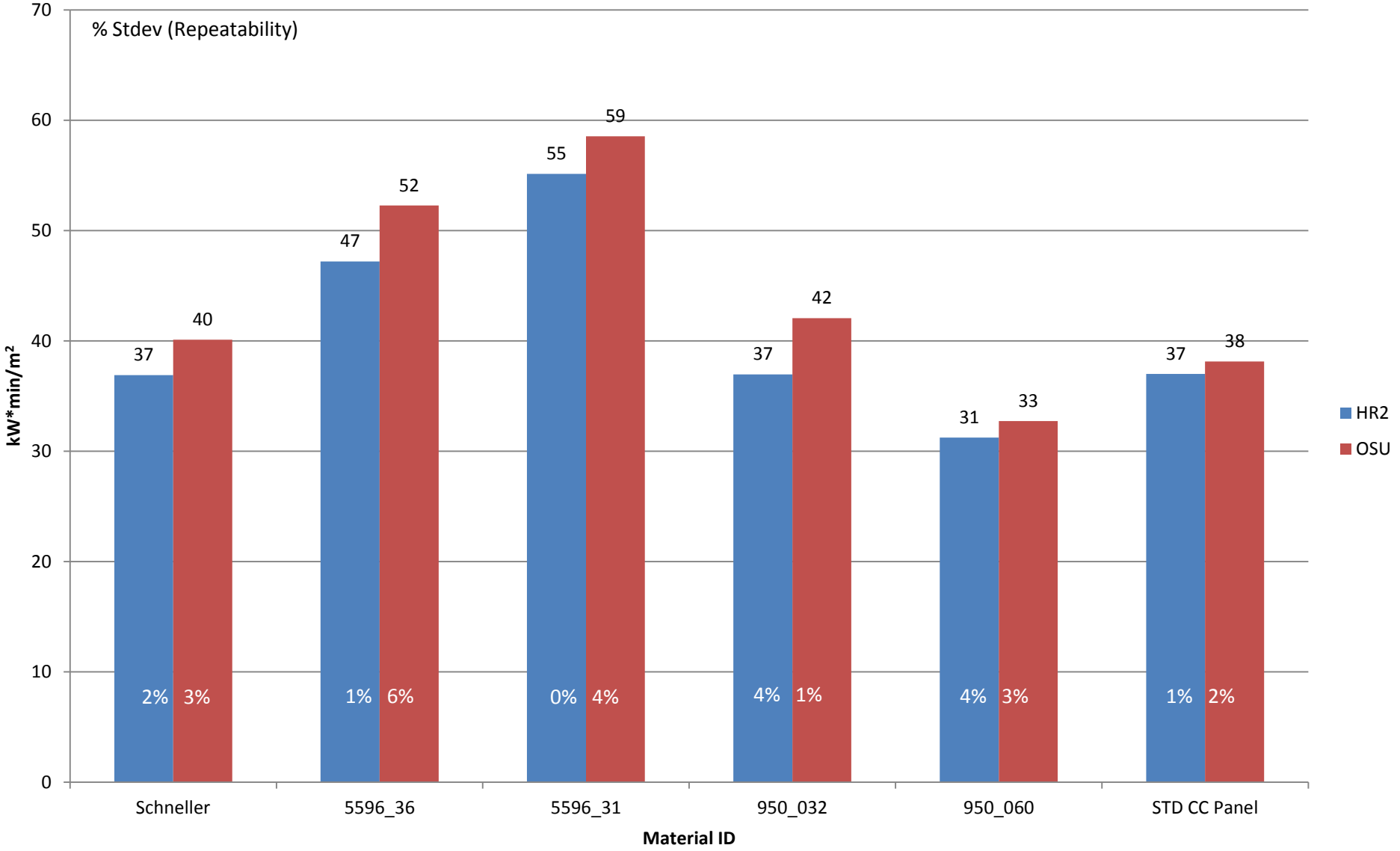
Peak Heat Release Rate



Time to Peak Heat Release Rate (seconds)



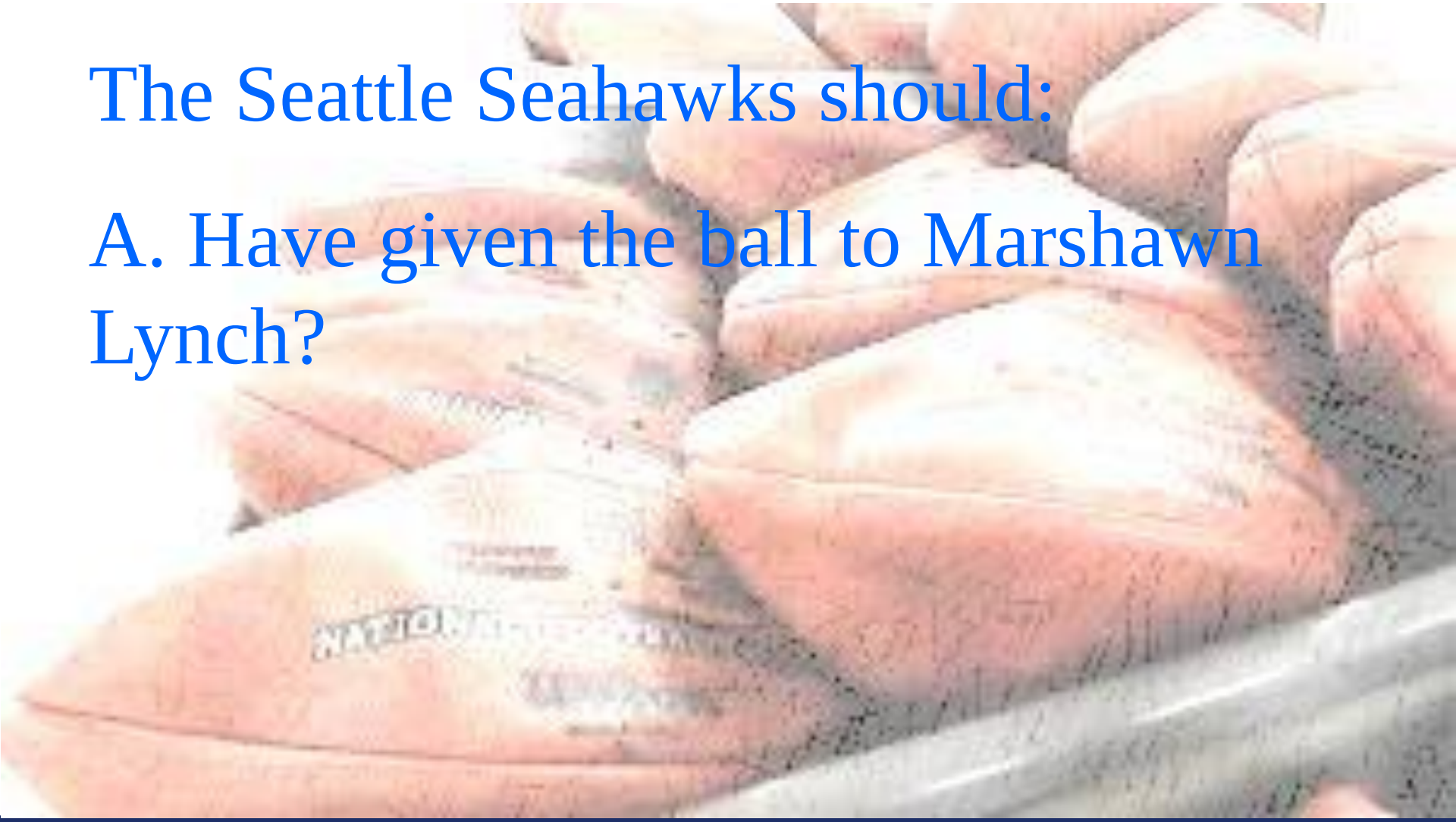
2-Minute Total Heat Release



NEXT

- Assemble larger Focus Group RR comparing HR2 (1) and Industry OSU's (13)
- Develop and Distribute Test plan and materials to participating labs
- Conduct RR Tests
- Reduce / Analyze Data for presenting at June WG meeting
- Complete the HSI development Project

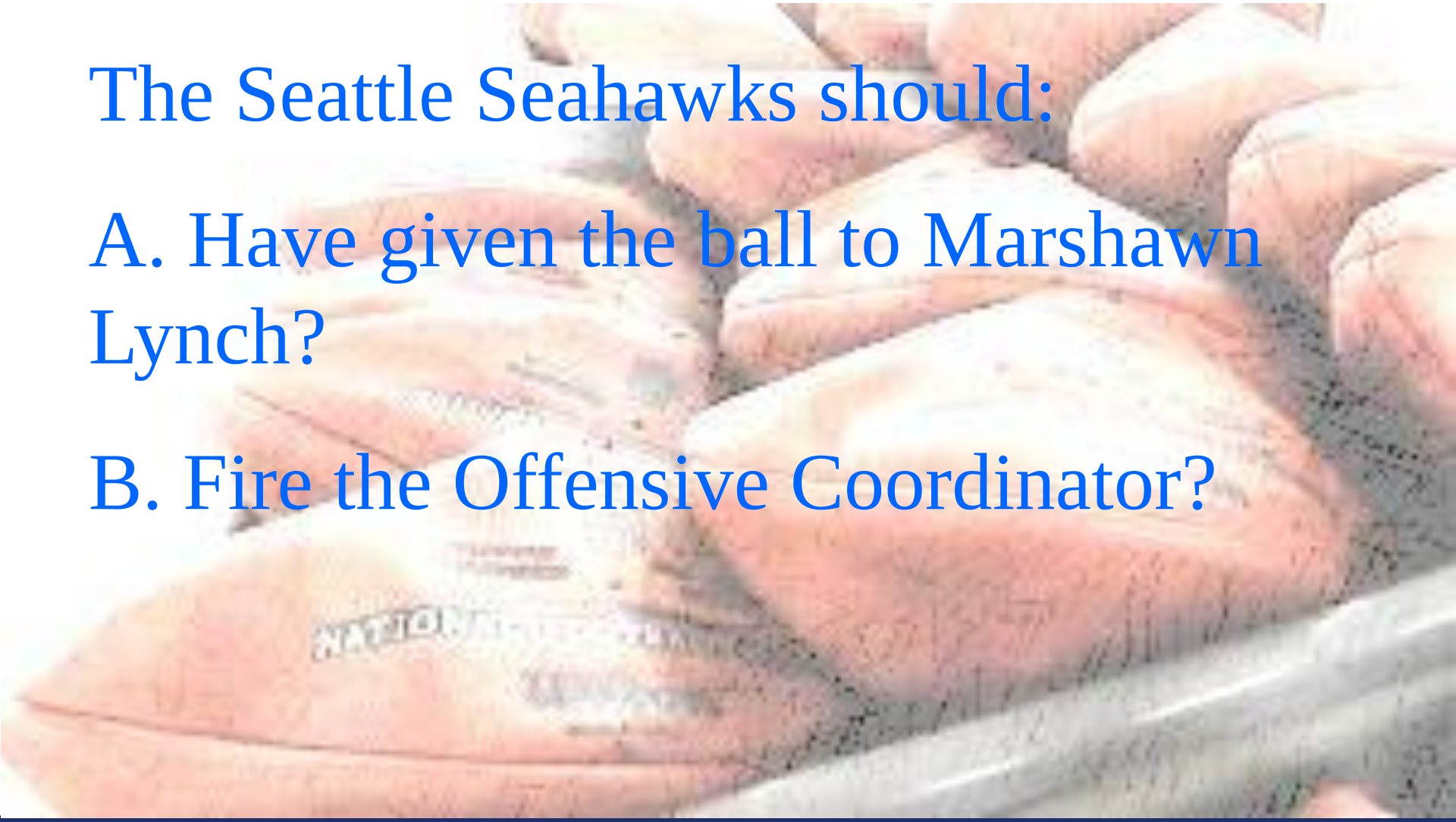
QUESTIONS?



The Seattle Seahawks should:

A. Have given the ball to Marshawn Lynch?

QUESTIONS?



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B. Fire the Offensive Coordinator?

QUESTIONS?

The Seattle Seahawks should:

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B. Fire the Offensive Coordinator?

C. GIVE UP AND BECOME PHILADELPHIA EAGLES FANS!!!