Authors Reply to Letter to the Editor, Comparative Room Burn Study of Furnished Rooms from the United Kingdom, France and the United State

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The corresponding author of the letter has questioned the independence and ethics of the testing laboratory and authors. Southwest Research Institute is a nonprofit research institute of which the Department of Fire Technology is on quarter of one of the 10 operating divisions. The experiments described here represent 0.01% of the annual operating budget of the institute and less than 3% of the Department of Fire Technology. Fire Tech does literally thousands of experiments every year, primarily for industry to ensure their products meet fire safety codes, regulations, and standards. The authors disclosed the funding source for this series of experiments in the journal article. It is important to note that the North American Fire Retardant Association and the American Chemistry Council had no control of the experimental design or the results reported in the journal article. As a direct corollary, the letter author makes income from organizations that oppose the use flame retardants in consumer products, manufacturers of mineral wool, as well as litigation against manufacturers of consumer products that result in injuries from fire. We would ask Mr. Babrauskus to disclose any Conflicts of Interest he may have related to the issues he raises.

To address each point in the letter, confounding variables in the paper including the flat screen TV. These rooms represent those most commonly found in lower income housing, i.e. older, smaller homes, and apartments as well as many hotel rooms. A recent study done by Dr. Marc Janssen used real-estate listing photos to look at Flat panel television installation. This study shows furniture load as well and TV mounting methods. This was used as instruction for furniture and TV location in a standard room burn configuration. Other factors affecting the test results were held as constant as possible and were not intended to influence the outcome.

Factors in test:

Furniture models were identical to manufacturer, size, color and location (within 1 cm in 2 dimensions). A total of 3 sets of Couch, Chair and TV were purchased in the stores of country of origin. A total of 9 sets were purchased.

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Rooms were standard construction IAW NFPA 286.

All other items commonly found in a room were purchased from Walmart.

Elemental analysis was performed on couch, chair and television components, for the purpose of finding if fire retardant elements were present but not identify individual chemistries as that was not the scientific objective of the test. We were not trying to advocate for specific chemistry.

The toxicity analysis quantified the chemicals present in the composited smoke, separate white smoke and later phase black smoke. Looking at the published toxicity values, chronic and acute, some conclusions can certainly be drawn. The data is quite clear on this. Also, composited smoke, white smoke and black smoke samples from each of the 9 trials in this program were subject to separate bio-assay studies. This work is being published and further supports the information presented in this paper.¹ An addition more complete study is in process of publication.

Babrauskas cites a McKenna et al. paper as stronger paper than the study being reviewed by his letter. The specific paper cited was thoroughly discredited by a letter to the editor published by Chemosphere because the data was manipulated to give misleading conclusions. McKenna presented the data as a function of the mass of emissions per mass of materials burned in the fires but failed to identify that significantly less mass was consumed in his testing for the FR case. When corrected for total mass burned the smoke was less toxic in the FR case.²

Babrauskas also criticizes the paper as not having sufficient literature review. This was not a review article and included those papers directly relevant. In addition a paper that was being published at the same time by a highly respected European laboratory, EFECTIS, authored by Eric Guillaume directly supports the results we obtained.³

Babrauskas goes on to criticize the study by claiming that it does not accurately reflect the real environment. While this is a laboratory test, we did endeavor to create a realistic fire load in the room, albeit a very clean and orderly room. As we all know, there is no standard room. In lower economic classes, rooms tend to be smaller and have more fire load of lower fire resistant quality. Add to that the factor that our furniture is brand new with any fire resistance being pristine while real furniture will have wear and tear. Further add that rooms often have paper product clutter: mail, magazines and possibly newspaper/add pages. The authors feel that the fire loading in the rooms represents a better than real condition for measuring fire safety. When considering the ignition sources, we used a standard open flame source to look at the impact of the worst possible ignition on the fire protection present in furniture. As Babrauskas states, only 7% of fires result from open flame, however, these fires result in a larger portion of the deaths in fire. Add

¹ The Toxicologist, Supplement to Toxicological Sciences, 174 (1), abstract #2810, 2020, In Vitro Assessment of Potential Chronic Toxicity of Smoke from Combustion of Flame-Retarded and Non Flame-Retarded Furnishings Osimitz, T.G, et al.

² M. S. Blais, Letter to the Editor for chemosphere reference Flame-retardants in UK Furniture increase smoke toxicity more than they reduce fire growth rate. McKenna et.al., 2017.

³ E. Guillaume et. al. An overview and experimental analysis of furniture fire safety regulations in Europe March 2020, *Fire and Materials* 44(5), <https://doi.org/10.1002/fam.2826>

to that, this represents more than 280 deaths per year in the US for the year 2018 with the number increasing. This is not a trivial number.

The location of the ignition is actual selected to give the furniture the largest chance of passing the tests. The junction of the back and seat cushions is the lowest location on the seat with gravity causing the fallen candle or other ignition source to have a higher probability of resting there. It is also one of the standard locations chosen for testing under BS 5852. The location is also highly visible for observing fire growth/fire spread.

Babrauskas raises a valid concern about the UK sofa, it should have had no progressive ignition through crib 5, when it actually completely burned with the smaller crib 4. We reported these results to the UK ministry responsible for regulating consumer goods. The ministry approached the manufacturer about this issue. The manufacturer responded that the particular piece of furniture was actually manufactured for a non-UK market based on a photograph provided of the tags of the furniture. This was not consistent however with the way the furniture item was procured. The Items were purchased from the one of the manufacturers stores in the UK and shipped to our laboratory by a third party logistics agency.

In Summary, no laboratory study perfectly mimics the real world. It is important to note that the “real world” has huge variability in construction types, condition of furniture, presence of fire hazards, and many other factors not sited here. So this type of argument is specious. The goal of testing is to be as realistic as possible as well as controlling as many variables as possible to make the tests repeatable. Some of this study has been successfully repeated at EFACTIS. This work was not designed to look directly at Fire Retardants but at the construction of furniture sold in different markets with different requirements for fire resistance testing. The authors met all ethical and technical standards for research and support the work as published.