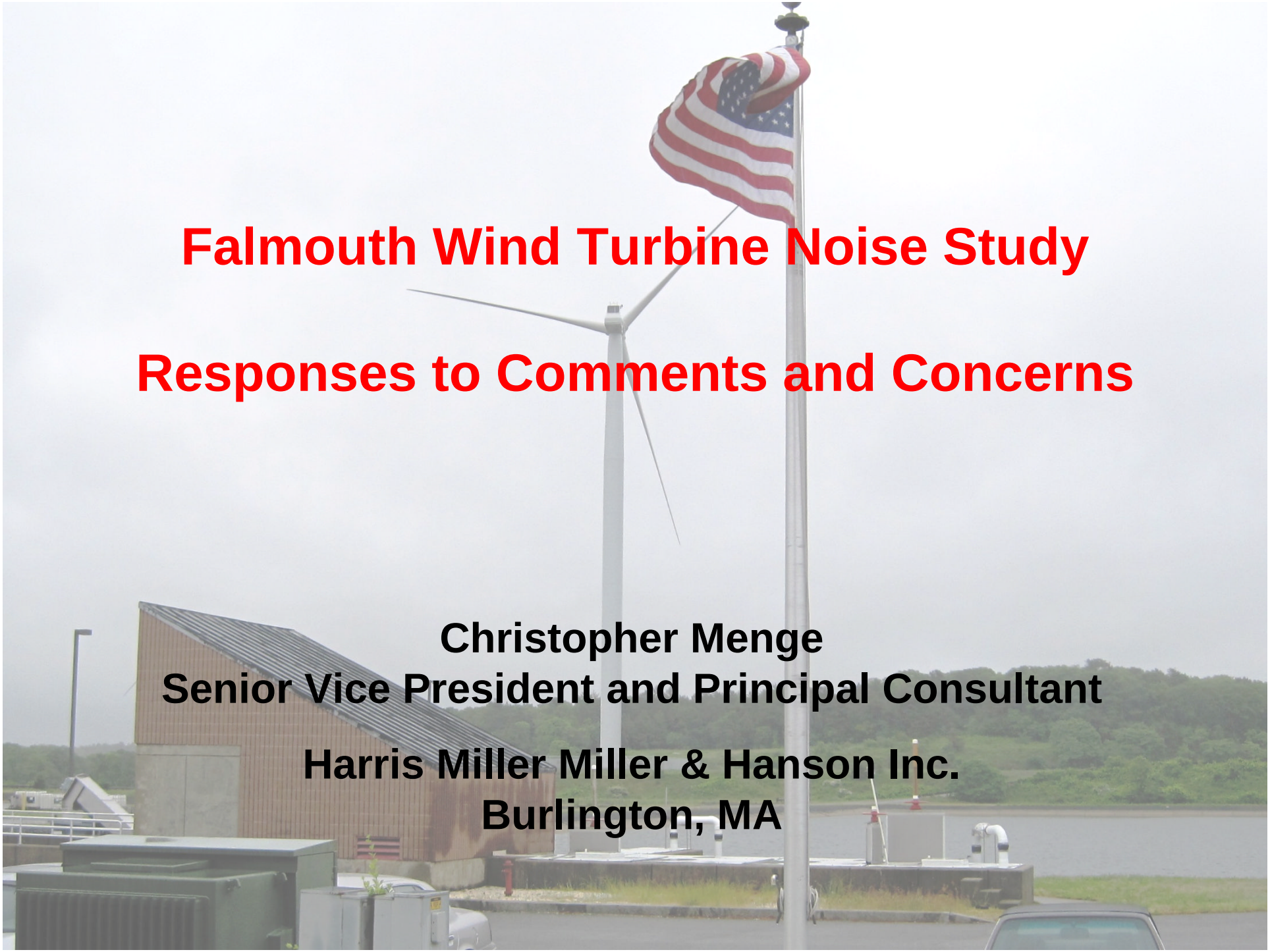

Falmouth Wind Turbine Noise Study

Responses to Comments and Concerns

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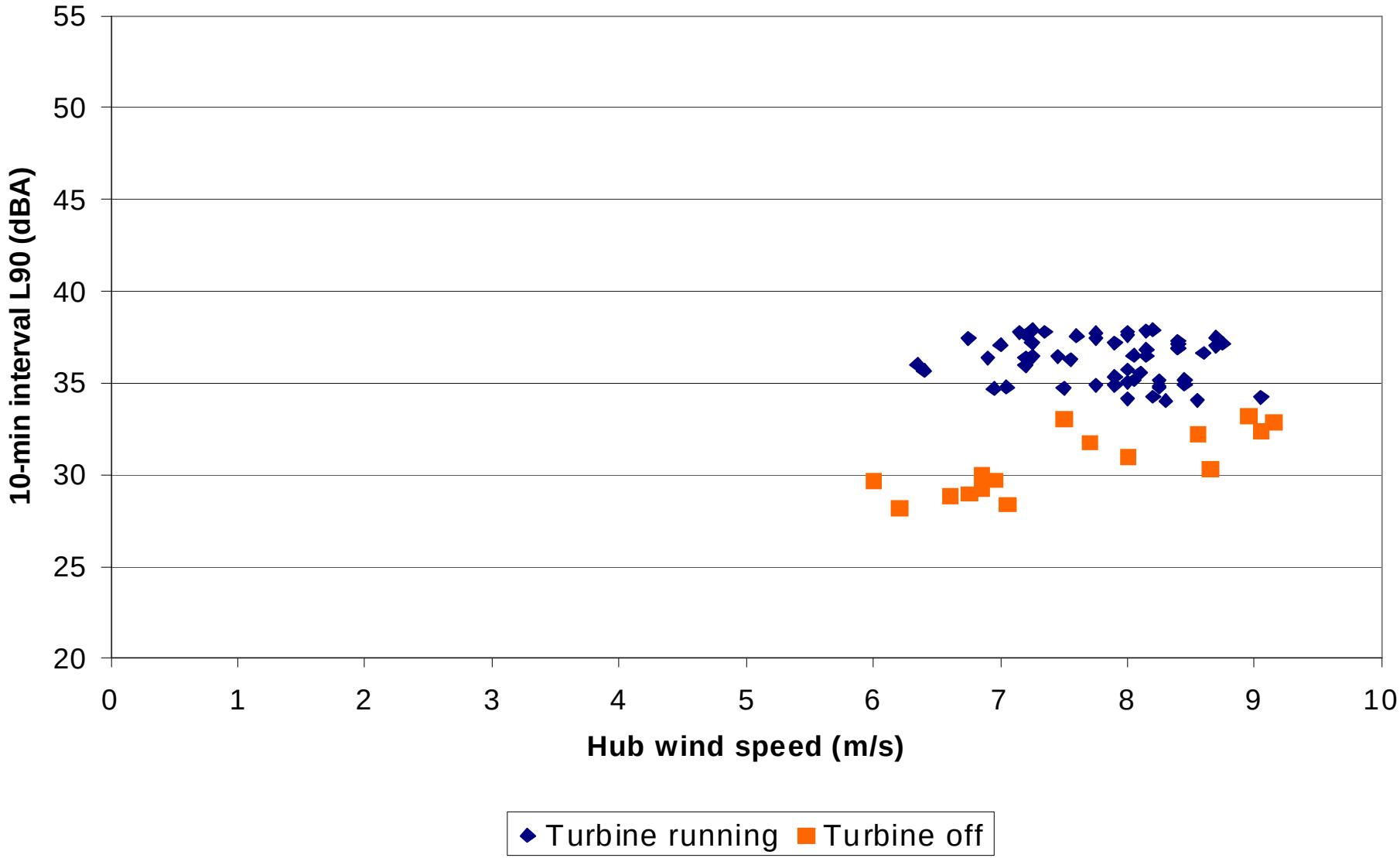
Falmouth Wind Turbine Noise Study
Responses to Comments and Concerns

- **Mr. Todd Drummey's presentation and comments about**
  - Measured sound levels above computed turbine noise levels
  - Wind shear and it's application to the background L90 at higher wind speeds
- **Comments about amplitude modulation**
- **Concerns about infrasound and low-frequency noise**
- **Letter from Mass DEP received commenting on study addendum – suggests additional attended monitoring**

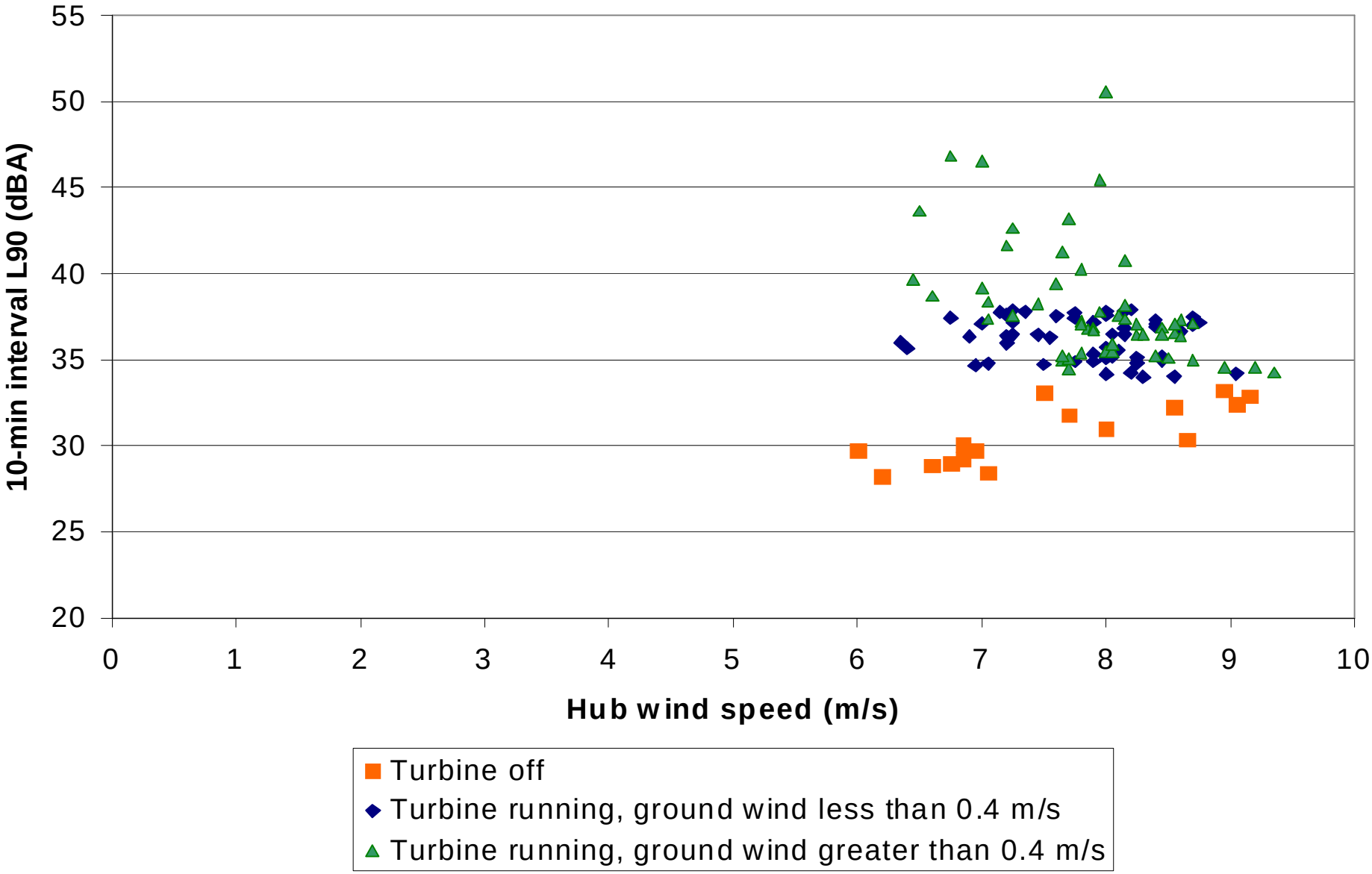
Comments about higher measured sound levels

- **No higher measured nighttime sound levels can be attributed to turbine noise**
  - Turbine noise generation correlates directly with hub wind speed, and does not vary from that relationship
- **Higher measured noise levels cannot be from the wind turbine, and are nearly certainly due to the higher ground-level wind rustling leaves in the trees**

LT-1 nighttime 10-min L90 vs. Hub wind speed
All data with low ground-level wind (0 to 0.4 m/s at LT-1) and hub wind between 6 and 10 m/s



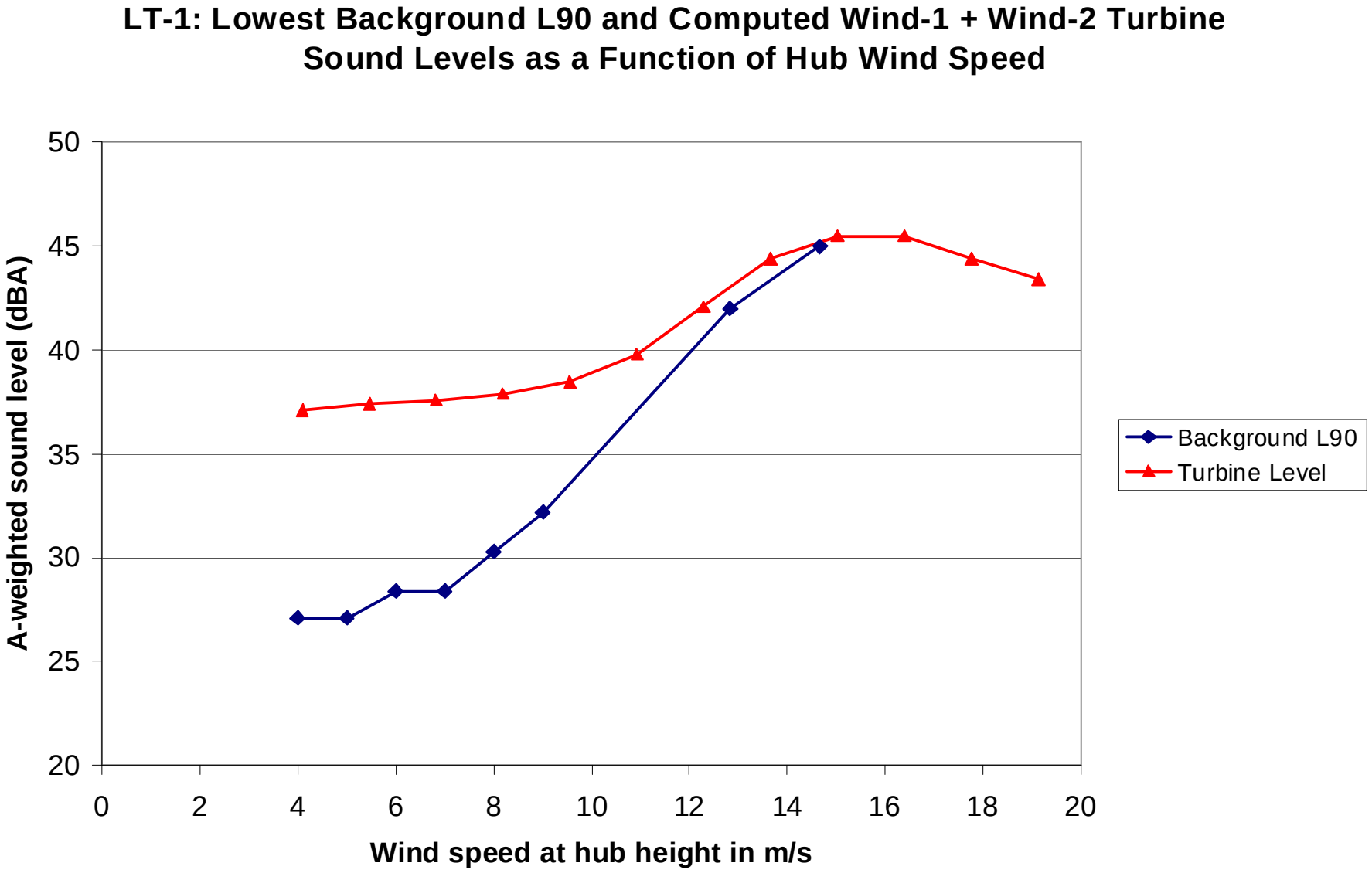
LT-1 nighttime 10-min L90 vs. average Hub wind speed
Including data with high ground-level wind speeds



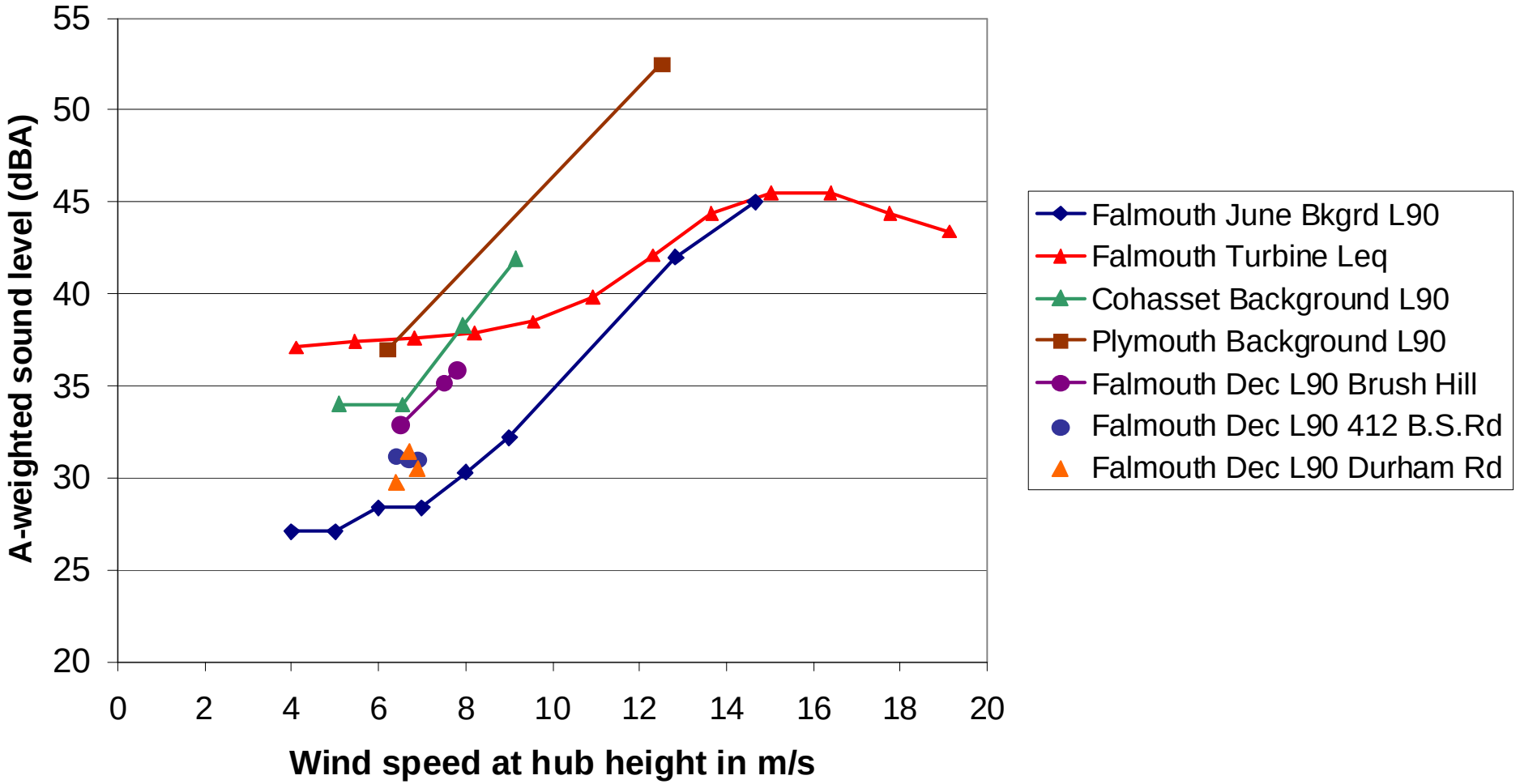
Comments about wind shear effect on background

- **Mr. Drummey inappropriately calculated wind shear across two different locations – Otis and Falmouth**
- **Lower wind shear value more appropriate at Otis Base where terrain is flat and open - yields lower wind at hub height**
- **Nevertheless, background noise levels assumed by HMMH for Falmouth are conservatively low, compared with measured noise levels:**
  - In Falmouth in December during the Notus (Webb) turbine noise compliance testing
  - In Cohasset, MA for a proposed wind project
  - In Plymouth, MA for a proposed wind project

Computed Wind-1 + Wind-2 Turbine Sound Levels relative to Quietest Background



Lowest Falmouth Background L90 and Computed Wind-1 + Wind-2 Turbine Sound Levels compared with Background L90 data from Notus (Webb) Turbine Dec. 2010 compliance measurements and Cohasset and Plymouth wind project sites



Comments about amplitude modulation

- Characteristic “Swish-Swish” sound about once per second from wind turbines has been described as “amplitude modulation” in acoustical literature
- Some research indicates that regular fluctuating sound of this kind may be more annoying to some people than random fluctuating sound, like road traffic noise, or steady sound at the same sound level
- To date, no consensus among acoustical professionals on how amplitude modulation could/should be handled differently in studies of noise effects on people – research is ongoing

Concerns about infrasound and low-frequency noise

- **Infrasound - defined as below frequency range of normal human hearing (below about 16 Hz)**
  - Infrasound can be heard if it is high enough in level
  - G-weighting network standardized in 1995 to characterize overall infrasound levels with a single number
  - Carefully-conducted scientific studies continue to show that wind turbines do not create levels of infrasound in communities high enough to be audible or create audible effects
  - Infrasound is very widespread, created by traffic, aircraft, wind, waves, commonly at levels higher than wind turbines
  - No scientific evidence of any harmful effects of inaudible infrasound

Concerns about infrasound and low-frequency noise

- **Low-frequency noise – defined as audible sound generally in range of 20 Hz to 200 Hz**
  - Wind turbines create some low-frequency sound, which can be audible when the background sound is low
  - In Falmouth, at times, levels of low-frequency sound were measured at 211 Blacksmith Shop Rd. to be up to 7 or 8 decibels higher than the background.
  - This increase is audible, but does not quite reach a characterization of “twice as loud,” which is an increase of about 9 to 10 decibels

Concerns about infrasound and low-frequency noise

- **Recent scientific study (June 2011) of infrasound and low-frequency noise from two wind farms with different turbines comparable to Falmouth turbine**
  - Worldwide literature search of unbiased standards and criteria
  - Field study outside and inside homes 1000 ft and 1500 ft away from nearest turbines two wind farms
  - At this distance, the wind farms met numerous standards and thresholds for annoyance from low-frequency sound both outdoors and indoors, including any rattle
  - No audible infrasound for most sensitive listeners
  - Should be no adverse public health effects from infrasound or low-frequency noise at distances greater than 1000 ft.

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