

## Supporting Information

### **Comparison of Modeled and Measured Indoor Air Trichloroethene (TCE) Concentrations at a Vapor Intrusion Site: Influence of Wind, Temperature, and Building Characteristics**

Elham Shirazi<sup>a</sup>, Gregory S. Hawk<sup>b</sup>, Chase W. Holton<sup>c</sup>, Arnold J. Stromberg<sup>b</sup>, Kelly G. Pennell\*<sup>a</sup>

<sup>a</sup> University of Kentucky, Department of Civil Engineering, Lexington, KY 40506, USA.

<sup>b</sup> University of Kentucky, Department of Statistics, Lexington, KY 40506, USA.

<sup>c</sup> Geosyntec Consultants, Denver, CO 80111, USA.

\*Corresponding Author: email: [kellypennell@uky.edu](mailto:kellypennell@uky.edu), Phone: +1 (859) 218-2540, Fax:

+1 (859) 257-4404

Table S1: Information related to zones

| Zone                | Zone number in Figure S2 | Height (m) | Area in CONTAM (m <sup>2</sup> ) |
|---------------------|--------------------------|------------|----------------------------------|
| First floor         |                          |            |                                  |
| Living area         | 1                        | 2.5        | 16.16                            |
| Stairwell           | 2                        | 2.5        | 5.76                             |
| Garage              | 3                        | 2.5        | 36.25                            |
| Laundry room        | 4                        | 2.5        | 5.66                             |
| Closet              | 5                        | 2.5        | 1.3                              |
| Bathroom            | 6                        | 2.5        | 4.48                             |
| Second floor        |                          |            |                                  |
| Living room         | 7                        | 2.5        | 33.71                            |
| Kitchen             | 20                       | 2.5        | 8.32                             |
| Closet in kitchen   | 17                       | 2.5        | 1.86                             |
| Bathroom            | 19                       | 2.5        | 4.78                             |
| Closet in bathroom  | 16                       | 2.5        | 0.5                              |
| Bedroom 1           | 18                       | 2.5        | 14.51                            |
| Closet in bedroom 1 | 13 and 14                | 2.5        | 0.76                             |
| Hallway             | 15                       | 2.5        | 3.47                             |
| Closet in hallway   | 8                        | 2.5        | 0.6                              |
| Bedroom 2           | 11                       | 2.5        | 10.07                            |
| Closet in bedroom 2 | 10                       | 2.5        | 1.18                             |
| Bedroom 3           | 12                       | 2.5        | 8.31                             |
| Closet in bedroom 3 | 9                        | 2.5        | 0.49                             |

Table S2: Information related to openings (Continue next page)

| Opening type      | Connection               | Opening number in Figure S2 | Width (cm) | Height (cm) | Level from floor (cm) | Relative elevation (cm) |
|-------------------|--------------------------|-----------------------------|------------|-------------|-----------------------|-------------------------|
| First floor       |                          |                             |            |             |                       |                         |
| Garage door       | Garage to outdoor        | 3                           | 486        | 213         | 0                     | 106.5                   |
| Window            | Garage to outdoor        | 4                           | 96         | 91          | 81                    | 126.5                   |
| Internal door     | Garage to stairwell      | 10                          | 99         | 200         | 0                     | 100                     |
| Internal door     | Laundry to stairwell     | 9                           | 76         | 204         | 0                     | 102                     |
| Window            | Laundry to outdoor       | 5                           | 94         | 94          | 99                    | 146                     |
| Door <sup>†</sup> | Living area to stairwell | 11                          | 57         | 206         | 0                     | 103                     |
| Internal door     | Living area to bathroom  | 8                           | 81         | 201         | 0                     | 100.5                   |
| Window            | Living area to outdoor   | 1                           | 150        | 81          | 109                   | 149.5                   |
| Window            | Bathroom to outdoor      | 6                           | 63.5       | 93          | 101.5                 | 148                     |
| Door              | Closet to bathroom       | 7                           | 150        | 210         | 0                     | 105                     |
| Front yard door   | Stairwell to outdoor     | 2                           | 89         | 203         | 0                     | 101.5                   |
| Second floor      |                          |                             |            |             |                       |                         |
| Window            | Living room to outdoor   | 11                          | 150        | 147         | 46                    | 119.5                   |
| Backyard Door     | Living room to outdoor   | 18                          | 180        | 200         | 0                     | 100                     |
| Window            | Kitchen to outdoor       | 17                          | 119        | 103         | 94                    | 145.5                   |

<sup>†</sup>Door was taken out

<sup>††</sup>Window was a circle window with 70cm diameter located above the entrance door

(Continue next page)

| Opening type | Connection | Opening number in | Width (cm) | Height (cm) | Level from floor (cm) | Relative elevation (cm) |
|--------------|------------|-------------------|------------|-------------|-----------------------|-------------------------|
|--------------|------------|-------------------|------------|-------------|-----------------------|-------------------------|

|                      |                       |           |                  |                  |     |       |
|----------------------|-----------------------|-----------|------------------|------------------|-----|-------|
|                      |                       | Figure S2 |                  |                  |     |       |
| Second floor         |                       |           |                  |                  |     |       |
| Door <sup>†</sup>    | Closet to hallway     | 29        | 61               | 204              | 0   | 102   |
| Internal door        | Bedroom 3 to hallway  | 28        | 76               | 204              | 0   | 102   |
| Internal door        | Bathroom to hallway   | 26        | 71               | 206              | 0   | 103   |
| Internal door        | Bedroom 1 to hallway  | 23        | 76               | 206              | 0   | 103   |
| Internal door        | Bedroom 1 to bathroom | 19        | 71               | 206              | 0   | 103   |
| Door                 | Closet to bedroom 1   | 21 and 22 | 117              | 202              | 0   | 101   |
| Window               | Bathroom to outdoor   | 16        | 117              | 27               | 175 | 188.5 |
| Door                 | Closet to bathroom    | 24        | 61               | 208              | 0   | 104   |
| Window               | Bedroom 1 to outdoor  | 15        | 150              | 120              | 79  | 139   |
| Window               | Bedroom 2 to outdoor  | 14        | 119              | 145              | 48  | 120.5 |
| Door                 | Closet to bedroom 2   | 31        | 147              | 202              | 0   | 101   |
| Door                 | Closet to bedroom 3   | 32        | 61               | 202              | 0   | 101   |
| Window               | Bedroom 3 to outdoor  | 13        | 119              | 150              | 48  | 123   |
| Window <sup>††</sup> | Stairwell to outdoor  | 12        | 70 <sup>††</sup> | 70 <sup>††</sup> | 264 | 299   |

<sup>†</sup>Door was taken out

<sup>††</sup>Window was a circle window with 70cm diameter located above the entrance door

Table S3: Effective leakage area corresponding to openings in study house (best estimate values suggested in ASHRAE Handbook of Fundamentals)

| Path       | Type                         | Units               | Best Estimate |
|------------|------------------------------|---------------------|---------------|
| Door frame | General                      | cm <sup>2</sup> /ea | 12            |
| Door       | Single, not weather-stripped | cm <sup>2</sup> /ea | 21            |

|                |                                    |                            |     |
|----------------|------------------------------------|----------------------------|-----|
| Exterior walls | Precast concrete panel             | $\text{cm}^2/\text{m}^2$   | 1.2 |
| Window framing | Masonry, uncaulked                 | $\text{cm}^2/\text{m}^2$   | 6.5 |
| Windows        | Single horizontal slider, aluminum | $\text{cm}^2/\text{lmc}^*$ | 0.8 |

\* lmc: linear meter of crack

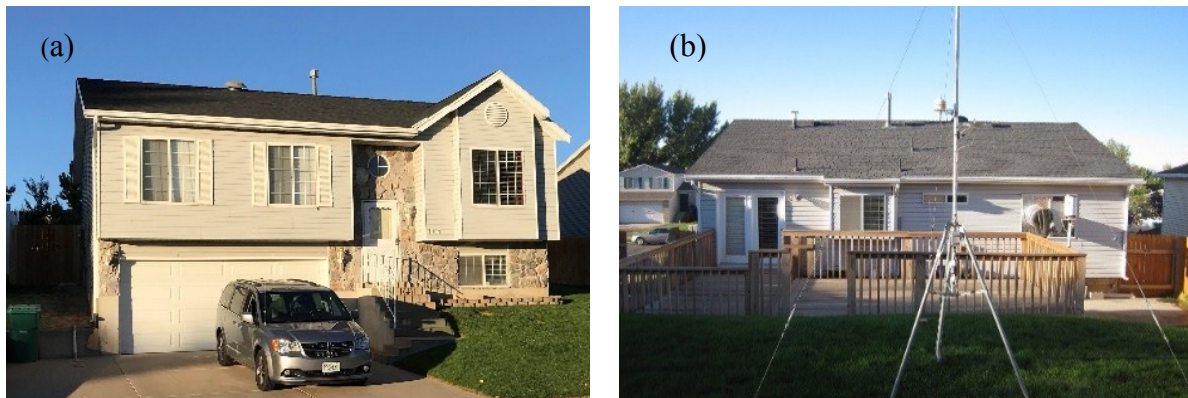


Figure S1: Front yard (a) and backyard (b) of study house.  
Photos taken by E. Shirazi, September 28, 2019.

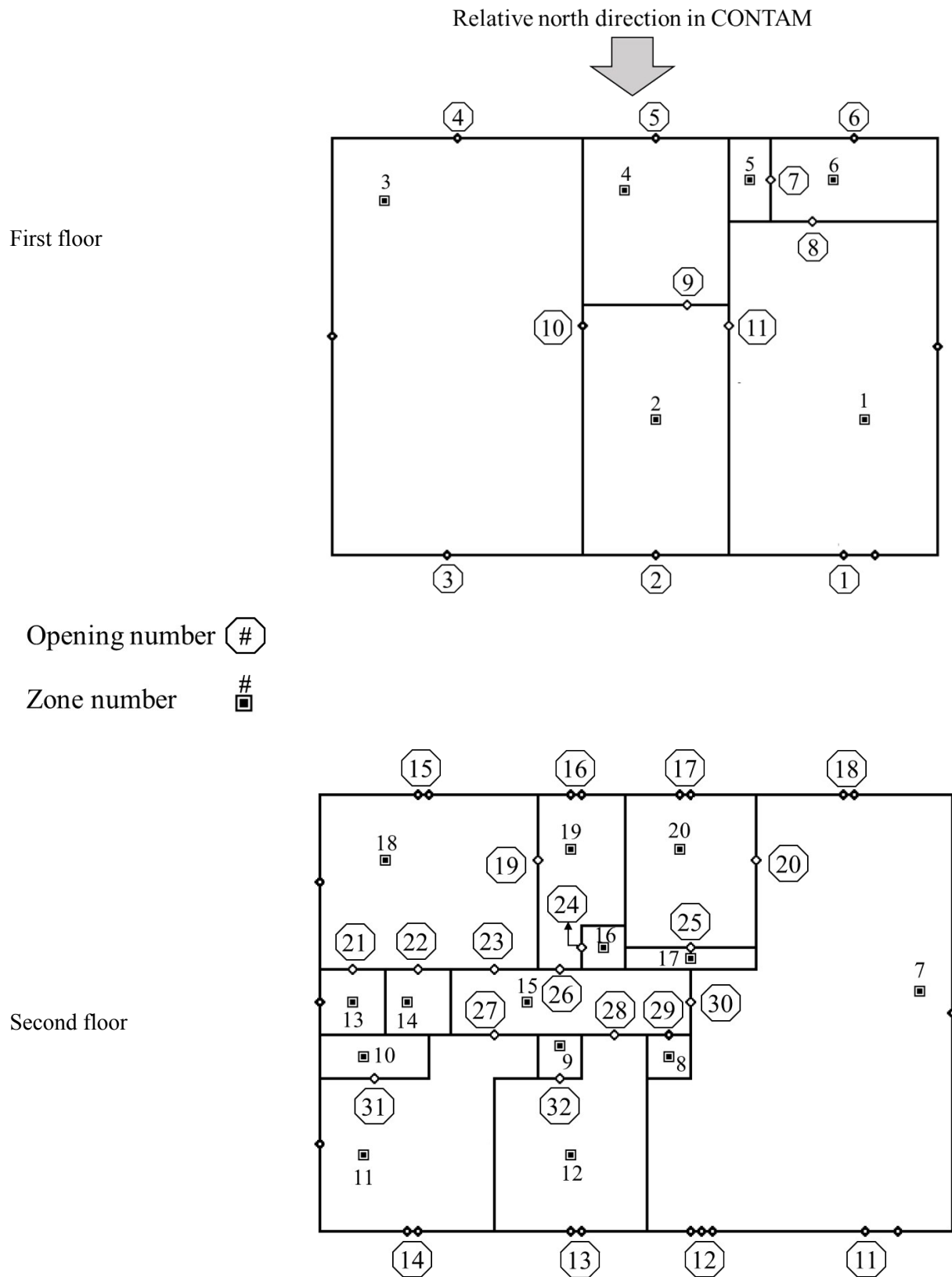


Figure S2: Zones and opening numbers related to Table S1 and Table S2 (openings shown in figures but not numbered are the openings considered for external walls)

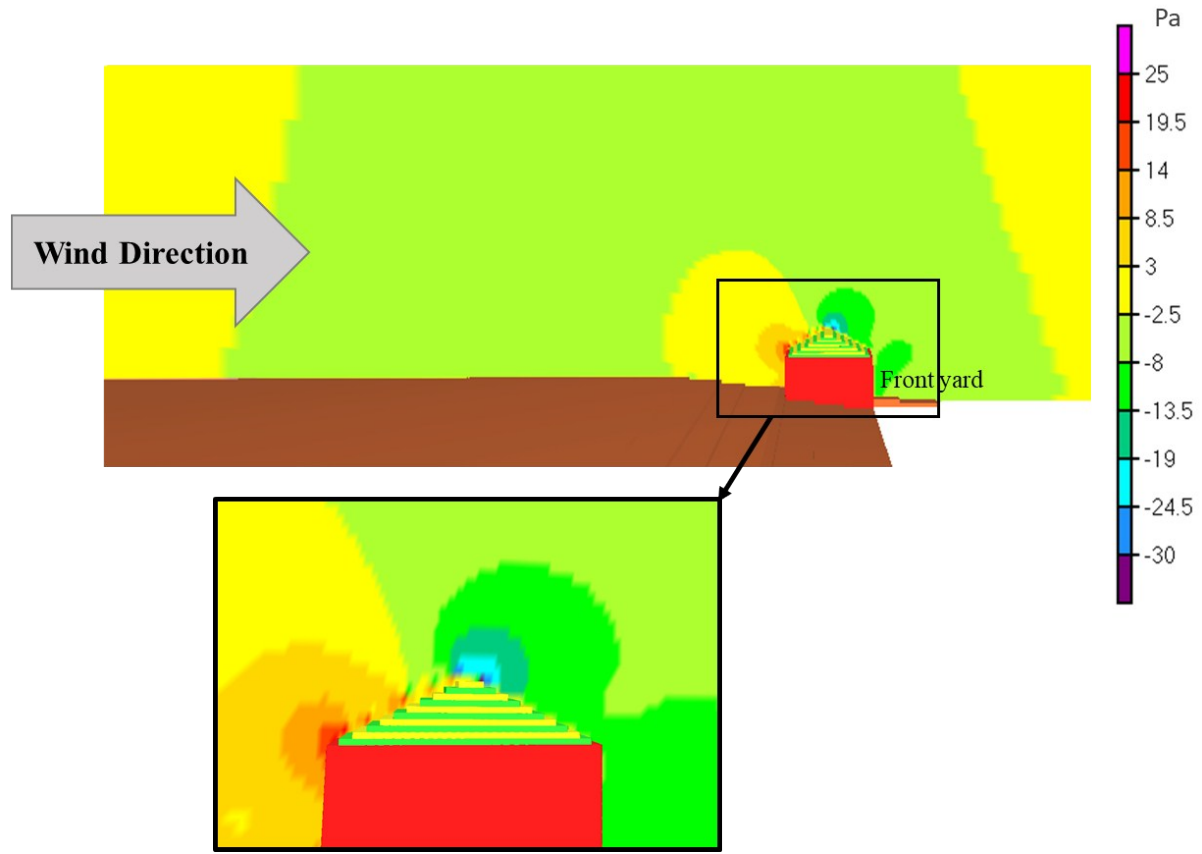


Figure S3: Pressure profile view from west side, 10 m/s is blowing from north side

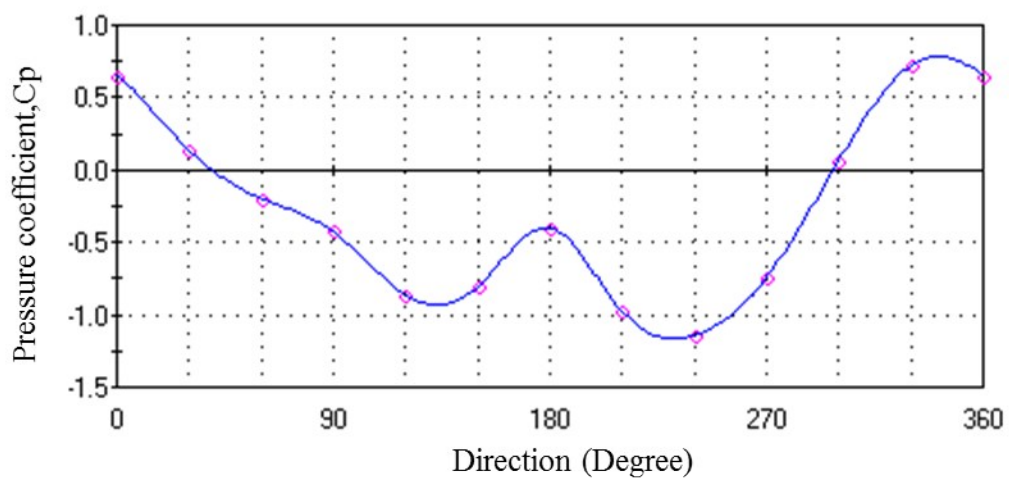


Figure S4: Pressure coefficient ( $C_p$ ) estimated by CFD0 for opening number 11 in second floor in Figure S1 (each opening has a specific  $C_p$  profile, opening 11 in second floor is chosen as an example)

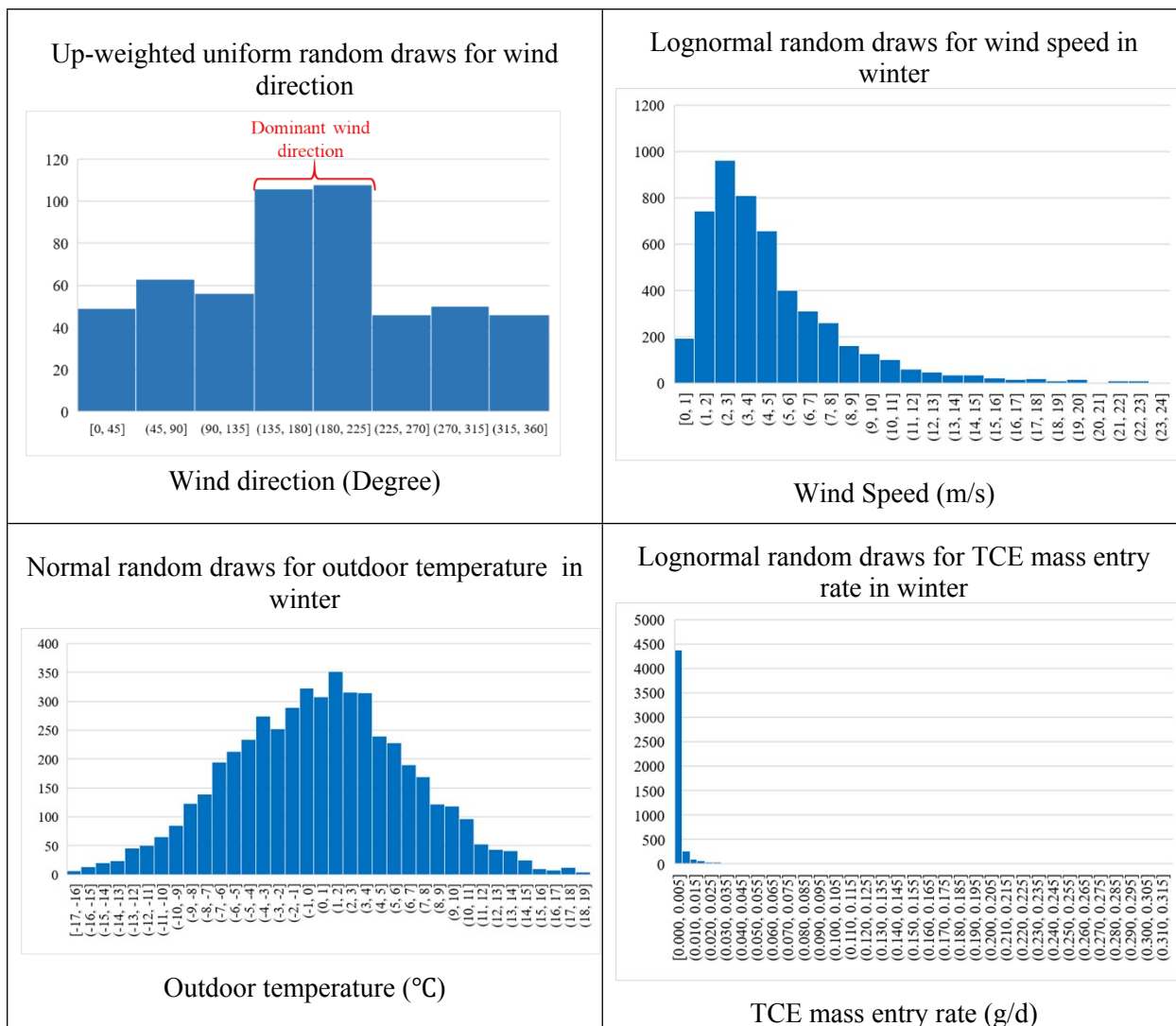


Figure S5: Histograms for random variables for winter



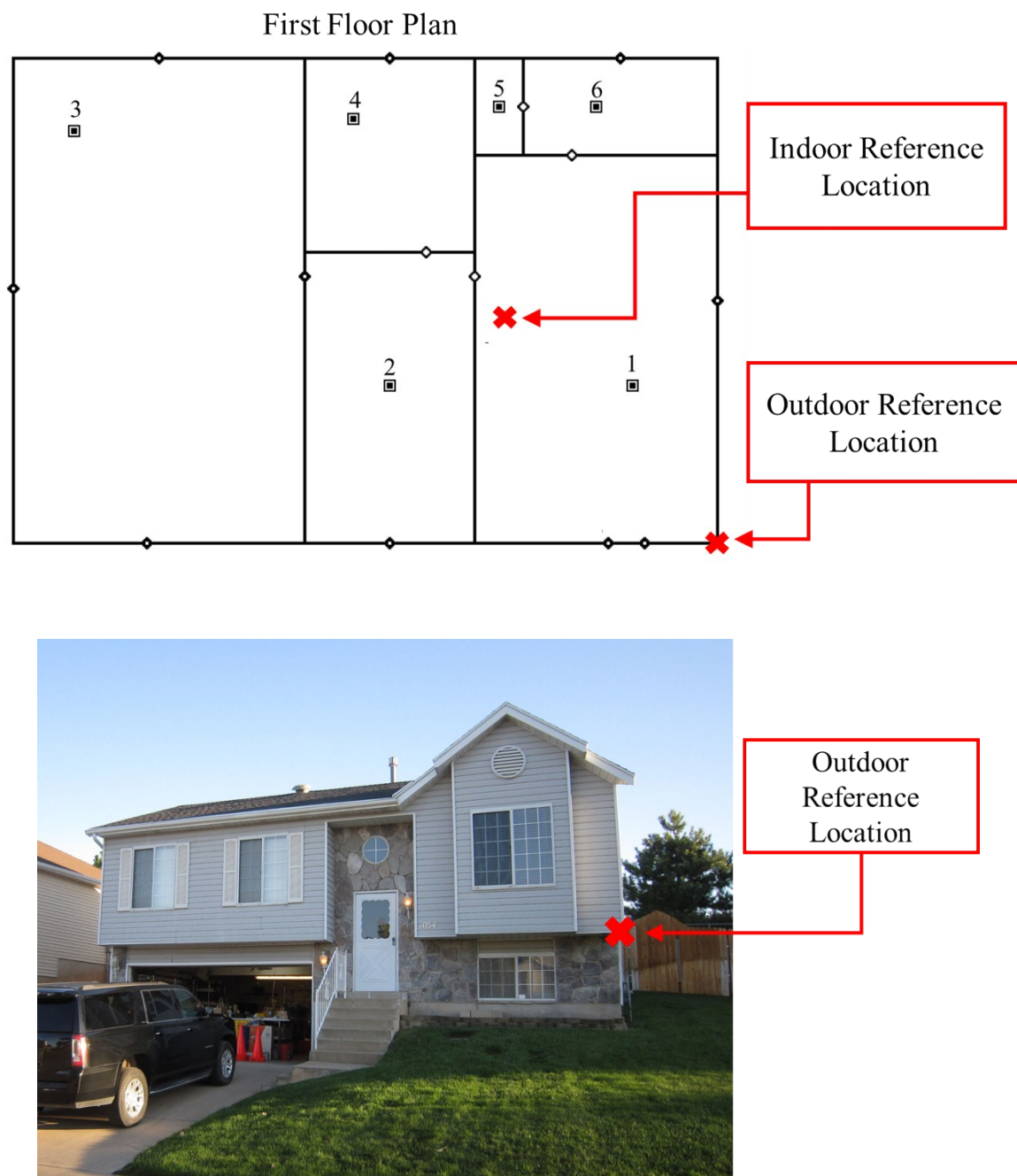


Figure S6: a) Indoor and outdoor reference locations for  $P_{\text{indoor}}-P_{\text{outdoor}}$ , b) the outdoor reference location was on the southeast corner of the house and underneath a slight overhang.