

# EnviroMed

*Cleaner environment. Safer workplaces.*

**Sub Slab Moisture Testing**  
for  
Oliver Ellsworth School  
730 Kennedy Road  
Windsor, Connecticut 06095

October 19, 23, 24, 25 and 26, 2023

*Prepared for*  
Town of Windsor  
275 Broad Street,  
Windsor, Connecticut 06095

EnviroMed Project # IH-23-1581

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## I. PROJECT NARRATIVE

### Overview

On October 19, 23, 24, 25, and 26, 2023, EnviroMed Services performed sub slab moisture testing at Oliver Ellsworth School located in Windsor, CT.

### Methods

The following sampling and assessment scheme was employed:

- Measure baseline moisture distribution across the entire concrete slab. All measurements were collected in accordance with ASTM Standard F2170, utilizing a RH/T-S3 sensor to determine relative humidity in concrete floor slabs.
- Minimum of three (3) tests for the first thousand (1000) ft sq and at least an additional test for each additional thousand (1000) ft sq.
- A 5/8" drill bit and rotary hammer drill was used for drilling. Drilled to 40% of the slab depth, calculations were performed to determine appropriate depth.
- Each hole drilled was vacuumed thoroughly using a HEPA Vacuum, cleaned with a screwdriver, and vacuumed again to ensure thoroughness per ASTM Standard F217.
- Eighty-three (83) holes were drilled across the entirety of the school. Yellow silicone sleeves were installed in each hole and the sleeves were left for twenty-four (24) hours to acclimate before testing.
- Inserted the Delmhorst Thermo- Hygrometer (HT-4000/HT-4000F) immediately into the first test hole and waited for an hour. Checked the sensor for drift and ensured that it did not drift more than one (1) percent RH over a five (5) minute period.
- The Delmhorst HT-4000 Handheld Thermo-hygrometer measures the following parameters ambient temperature (°F), relative humidity (RH), calculates dewpoint (DEW), absolute humidity (GPP), and vapor pressure (PSI). At each sampling location, the industrial hygienists waited for the instrument to adjust to the surrounding environment, and then recorded the measurements when the readings stabilized.

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## Summary of Results

### Real-Time Sub Slab Moisture Results:

Real-time sub slab moisture distribution readings across the entire slab were conducted under the direction of a Senior Industrial Hygienist in accordance with ASTM Standard F2170. Designated industrial hygienists were assigned to quantify moisture levels for the schools concrete flooring, which included ambient temperature in °F, relative humidity (RH), Dewpoint (DEW), absolute humidity (GPP), and vapor pressure (PSI). **Appendix A** of this report contains the complete Concrete Floor Moisture Sub Slab Logs.

**Ambient Temperature:** The ambient concrete sub- slab temperatures ranged from **59.5 to 75.8 °F**.

**Relative Humidity:** Per ASTM Standard F2170 the relative humidity (RH) is recommended to be at or below 75% when installing resilient flooring. The relative humidity levels within the school ranged from **52.6 % to 85.7%**. The relative humidity was higher than the recommended range in the following rooms: Room 12, Hallway Across 12, Hallway Between Room 7 & 8, Room 8, Room 7, Office Between C & D, Room 14, Room 15, Hallway Across from 15, Hallway Near Classroom 18, Room 22, Room 21, Room 19, Hallway Near F, Hallway Near Bathroom, Bulk Storage, Room 30, Staff Bathroom, Room 25, Room 3, Room P, Room 6, Kitchen Hallway, Hallway Near Exit 10 & Room J.

**Dewpoint:** Dewpoint is the temperature in the air in which humidity in the air begins to condense in and on the concrete slab. The sub slab dewpoint values ranged from **53.8 to 68.53 °F**.

**Absolute Humidity:** The absolute relative humidity of the sub- slab concrete within the school ranged from **56.78 to 103.3**.

### **Vapor Pressure**

Vapor pressure is the natural tendency of moisture to seek equilibrium by moving across areas of high concentration to areas of low concentration in the form of water vapor. The vapor pressure range for the sub-slab concrete moisture testing ranged from **0.200 to 0.340 PSI**.

## Conclusions

- The relative humidity levels within the concrete floors ranged from **52.6 % to 85.7%**.
- The relative humidity within the concrete slab floors was higher than the recommended range in the following rooms: Room 12, Hallway Across 12, Hallway Between Room 7 & 8, Room 8, Room 7, Office Between C & D, Room 14, Room 15, Hallway Across from 15, Hallway Near Classroom 18, Room 22, Room 21, Room 19, Hallway Near F, Hallway Near Bathroom, Bulk Storage, Room 30, Staff Bathroom, Room 25, Room 3, Room P, Room 6, Kitchen Hallway, Hallway Near Exit 10 & Room J.
- The ambient concrete sub- slab temperatures ranged from **59.5 to 75.8 °F**.
- The sub slab dewpoint values ranged from **53.8 to 68.53 °F**.
- The absolute relative humidity of the sub- slab concrete within the school ranged from **56.78 to 103.3**.
- The vapor pressure range for the sub-slab concrete moisture testing ranged from **0.200 to 0.340 PSI**.

## Discussion – For Laymen

- The existing concrete slab at the school does not have a moisture retarding vapor barrier under the concrete slab. Older construction typically does not have a plastic or asphaltic vapor barrier under the concrete slab. Newer construction usually has a vapor barrier under the slab. A vapor barrier impedes the migration of water vapor from the soil under the slab through the slab into the building. If the school did have a moisture barrier under the slab, we would see relative humidity levels in the slab below 50% - a dry slab. Since Oliver Ellsworth School has no vapor barrier, we see relative humidity levels in the slab in the 50-85% range – a moist slab. If we had very wet soil under the slab due to poor drainage or high water table, then we would see 90%+ relative humidity levels in the slab – a wet slab.
- When a building has a wet slab (90%+ relative humidity) or a moist slab above 75% relative humidity, the moisture impedes the bond of flooring materials. Vinyl composition floor can delaminate, mold can grow in the seams of the flooring, and carpet can smell in a building with a wet slab or 75%+ moist slab.

- Vinyl floor tile and carpet can be installed in a building with a wet slab, but you have to install a moisture mitigation product, usually a 2 part epoxy base liquid (Ardex MC Rapid or equal), before you install the flooring material. Essentially, you are installing a vapor barrier on top of the slab to stop water vapor migration instead of installing the vapor barrier under the slab during construction. 2 part epoxy moisture mitigation materials are on the expensive side – typically around \$500 for a 5 gallon pail.
  
- For buildings with a moist slab, like Oliver Ellsworth School, for best practices during new flooring installation, a single part moisture vapor (Ardex VB 100 or equal) should be applied to the slab prior to the adhesion of new flooring. The single part moisture vapor barrier products are less expensive and easier to apply than the 2 part epoxy moisture mitigation products.
  
- Oliver Ellsworth School was observed to have newer vinyl composition floor tile (VCT) in most all classrooms, storage, & office spaces, older vinyl asbestos floor tile (VAT) left in 1 or 2 rooms, ceramic tile in bathrooms & wet areas, carpet in corridors, and a wood floor with a tar paper & cork backing in the Gym. The ceramic tile, VCT, and VAT will do a decent job stopping water vapor transmission through the floor into the school. Carpet will do a fair to poor job stopping water vapor transmission through the floor depending on the characteristics of the carpet adhesive used. The wood Gym floor will do a good job stopping water vapor transmission through the floor due to the tar paper backing layer.
  
- So, what do we recommend for Oliver Ellsworth School for the floor slab and flooring products with regards to moisture contributions to the indoor air quality in the school by the concrete slab:
  - For VCT & VAT floors, do nothing to the floors. The District has already taken the school, which originally had a 90/10 ratio of carpet to VCT, and flipped it to a 10/90 ratio of carpet to VCT – that did good things for water vapor transmission through the floor in the school. When the flooring is eventually replaced in 10 to 20 years, then use a single part moisture vapor on the concrete slab prior to VCT installation.
  - For ceramic tile floors do nothing to the floors.

- For the wood Gym floor, it looks like the floor will need replacement in the next 5 years due to humidity issues in the Gym. Make sure a slab moisture vapor barrier and an under floor air gap is incorporated into the new Gym floor design.
- For carpeted corridor floors, when carpet replacement is performed in the future, use a single part moisture vapor on the concrete slab prior to carpet installation.
- Take a look at the drainage at the foundation walls around the perimeter of the school. It looks like there are old clogged drains in the pavement right up against the foundation walls that are in need of cleaning or replacement. It looks like the grading to the drains has been changed through generations of new pavement. Proper grading & drainage around the perimeter of the school would help keep water out from under the slab and reduce the water vapor transmission pressure through the slab into the school. Reduced water vapor transmission pressure in the slab will increase the useful life of the VCT and carpet in the school.



**APPENDIX A**  
**Concrete Floor Moisture Sub Slab Logs**



ENVIROMED SERVICES								
CONCRETE FLOOR MOISTURE TESTING								
BUILDING: Oliver Ellsworth School, 730 Kennedy Rd, Windsor, CT								
DATE OF TESTING:								
EQUIPMENT: DELMHORST HT-4000F THERMO-HYGROMETER, CS-3 SLEEVES								
ACCLIMATION TIME: 24 HOURS								
SLAB TYPE:								
METHODOLOGY: ASTM F2170 AS AMENDED DEC 2017								
Room # or Location	Sample #	Date	Time	RH (%)	Temp (°F)	GPP	DEW (°F)	PSI
Room 10 (No. 43)	1	10/25/2023	4:45	71.2%	68.9	74.97	59.2	0.249
Room 11 (No. 42)	2	10/25/2023	4:49	72.8%	69.7	79.10	60.6	0.264
Room 12 (No. 41)	3	10/25/2023	4:52	80.2%	71.1	90.65	64.4	0.302
Room 13 (No. 40)	4	10/25/2023	4:54	73.0%	70.9	79.66	60.8	0.266
Hallway Across 12 (No. 3)	5	10/25/2023	4:58	75.8%	69.8	83.30	61.7	0.276
Room 9 (No. 37)	6	10/25/2023	5:01	66.6%	68.7	69.23	56.8	0.232
Hallway Between 7&8 (No. 36)	7	10/25/2023	5:09	85.0%	70.7	94.50	65.5	0.314
Room 8 (No. 35)	8	10/25/2023	5:12	83.3%	69.6	90.30	64.4	0.300
Room 7 (No. 34)	9	10/25/2023	5:15	82.2%	69.6	90.23	63.9	0.299
Room 6 (No. 33)	10	10/25/2023	5:17	74.4%	70.1	82.40	61.7	0.275
Room 5 (No. 32)	12	10/25/2023	5:20	68.8%	70.3	77.00	59.7	0.256
Room A (No. 30)	13	10/25/2023	5:22	70.8%	70.0	78.26	60.4	0.260
Room B (No. 31)	14	10/25/2023	5:25	73.0%	69.0	77.91	60.1	0.258
Hallway Near Room C (No. 29)	15	10/25/2023	5:27	66.2%	69.7	71.96	58.1	0.240
Room C (No. 51)	16	10/25/2023	5:32	63.0%	69.4	67.83	56.3	0.227
Office Behind C & D (No. 52)	17	10/25/2023	5:36	75.5%	68.8	80.78	61.0	0.368
Room D (Library) (No. 53)	18	10/25/2023	5:38	63.0%	66.9	62.16	53.8	0.208
Room 14 (No. 54)	19	10/25/2023	5:43	82.7%	69.1	87.99	63.3	0.291
Room 15 (No. 55)	20	10/25/2023	5:45	74.0%	70.5	83.37	61.9	0.276
Room 16 (No. 56)	21	10/25/2023	5:48	78.2%	70.1	85.03	62.6	0.284
Room 17 (No. 57)	22	10/25/2023	5:51	74.3%	69.8	81.27	61.2	0.270
Hallway Across 15 (No. 58)	23	10/25/2023	5:54	81.2%	70.0	90.16	64.2	0.300
Room 18 (No. 60)	24	10/25/2023	5:56	72.8%	70.0	79.52	60.4	0.261
Hallway Near 18 (No. 63)	25	10/25/2023	5:59	85.7%	69.9	94.92	65.7	0.313

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Room # or Location	Sample #	Date	Time	RH (%)	Temp (°F)	GPP	DEW (°F)	PSI
Room 22 (No. 61)	26	10/25/2023	6:02	75.2%	69.6	81.76	61.7	0.273
Room 21 (No. 62)	27	10/25/2023	6:05	75.7%	69.7	82.53	61.7	0.270
Room 20 (No. 64)	28	10/25/2023	6:07	60.6%	71.2	71.14	57.2	0.234
Room 19 (No. 65)	29	10/25/2023	6:10	76.6%	70.0	84.42	62.2	0.281
Room F (No. 71)	30	10/25/2023	6:13	74.4%	70.8	83.09	61.9	0.278
Hallway Near F (No. 66)	31	10/25/2023	6:14	78.4%	70.8	88.97	63.7	0.295
Room 27 (No. 68)	32	10/25/2023	6:18	61.6%	71.4	68.88	56.7	0.230
Hallway Near Bathrooms (No. 69)	33	10/25/2023	6:20	81.9%	70.4	91.56	64.6	0.304
Room 28 (No. 72)	34	10/25/2023	6:22	68.3%	70.8	78.34	60.1	0.258
Room 29 (No. 73)	35	10/25/2023	6:24	74.1%	69.0	78.54	60.3	0.260
Bulk Storage (No. 74)	36	10/25/2023	6:27	75.9%	65.6	72.17	58.1	0.240
Room 30 (No. 75)	37	10/25/2023	6:29	89.1%	68.1	91.98	64.8	0.305
Staff Bathroom (No. 76)	38	10/25/2023	6:32	78.6%	69.1	84.21	62.2	0.208
Room 23 (No. 77)	39	10/25/2023	6:34	62.9%	69.5	68.67	56.7	0.230
Room 24 (No. 78)	40	10/25/2023	6:36	65.9%	69.8	72.17	58.1	0.241
Hallway (No. 79)	41	10/25/2023	6:37	70.6%	68.0	72.03	58.1	0.240
Room 25 (No. 80)	42	10/25/2023	6:39	79.5%	68.4	82.6	61.7	0.277
Room 26 (No. 81)	43	10/25/2023	6:41	67.7%	68.8	71.4	57.7	0.238
Main Entrance (No. 1)	44	10/25/2023	7:10	63.4%	71.4	73.19	60.7	0.246
Main Office (No. 2)	45	10/25/2023	7:12	61.5%	71.0	70.14	57.0	0.235
Nurses Office (No. 3)	46	10/25/2023	7:13	55.7%	70.3	62.23	54.0	0.208
Room 1 (No. 23)	47	10/25/2023	7:16	66.6%	71.5	77.42	60.1	0.258
Room 2 (No. 24)	48	10/25/2023	7:18	55.6%	72.1	66.22	55.4	0.220
Room 3 (No. 25)	49	10/25/2023	7:20	83.9%	71.8	98.98	66.9	0.328

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Room # or Location	Sample #	Date	Time	RH (%)	Temp (°)	GPP	DEW (°F)	PSI
Room 4 (No. 26)	50	10/25/2023	7:23	65.2%	71.8	76.70	59.9	0.256
Hallway Across 4 (No. 29)	52	10/25/2023	7:25	65.5%	70.8	74.97	59.4	0.249
Room I (No. 27)	53	10/25/2023	7:27	57.0%	59.5	61.18	53.4	0.203
Stage (No. 82)	54	10/25/2023	7:30	69.3%	70.8	79.17	60.4	0.261
Room K (No. 4)	55	10/25/2023	7:32	61.0%	72.0	72.03	58.3	0.242
Girls Locker Room (No. 5)	56	10/25/2023	7:34	52.6%	71.6	61.67	63.4	0.205
Gymnasium (No. 6)	57	10/25/2023	7:36	61.2%	69.7	66.78	55.8	0.224
Gymnasium (No. 8)	58	10/25/2023	7:39	70.0%	65.8	65.24	55.2	0.217
Gymnasium (No. 7)	59	10/25/2023	7:42	63.8%	67.4	62.93	54.0	0.240
PE Storage (No. 11)	60	10/25/2023	7:43	65.3%	68.2	66.99	55.9	0.224
PE Office (No. 10)	61	10/25/2023	7:46	71.8%	69.0	76.30	59.7	0.252
Boys Locker Room (No. 9)	62	10/25/2023	7:47	75.3%	68.7	79.38	60.6	0.263
Custodian Closet (No. 47)	63	10/25/2023	7:50	85.2%	71.0	78.00	66.6	0.325
Room P (No. 83)	64	10/25/2023	7:53	58.3%	71.0	56.78	55.9	0.224
Custodial Closet (No. 38)	65	10/25/2023	7:58	63.2%	70.0	69.65	57.2	0.233
Custodial Closet (No. 59)	66	10/25/2023	8:01	68.9%	70.0	76.02	59.5	0.254
Room G (No. 67)	67	10/25/2023	8:03	84.6%	70.2	94.15	65.3	0.312
Electrical Closet (No. 46)	68	10/25/2023	8:08	79.9%	68.6	83.37	61.7	0.274
Custodial (No. 28)	69	10/25/2023	8:10	66.1%	72.2	78.68	60.4	0.264
Boiler Room (No. 45)	70	10/25/2023	8:18	79.7%	74.7	103.3	68.2	0.340
Cafeteria (No. 12)	71	10/25/2023	8:21	64.6%	70.4	72.31	58.3	0.241
Cafeteria (No. 13)	72	10/25/2023	8:24	69.2%	75.8	59.5	59.2	0.253
Cafeteria (No.14)	73	10/25/2023	8:26	78.3%	68.6	82.46	61.9	0.274
Kitchen (15)	74	10/25/2023	8:29	74.4%	64.5	68.04	56.5	0.227

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Kitchen Hallway (No. 16)	75	10/25/2023	8:34	78.1%	66.3	75.81	58.5	0.254
Inc. Room (No. 17)	76	10/25/2023	8:36	64.0%	69.1	68.11	56.3	0.227
Custodial Wet Area (VOID)	77	10/25/2023						
Room M (No. 21)	78	10/25/2023	8:38	64.9%	70.3	72.52	68.53	0.242
Garage (No. 22)	79	10/25/2023	8:40	66.5%	62.8	67.83	56.1	0.226
Hallway Near Exit 10 (No. 49)	80	10/25/2023	8:42	85.6%	66.9	84.70	62.4	0.281
Room J (No. 48)	81	10/25/2023	8:44	76.2%	69.7	82.88	61.7	0.275
Cafeteria Storage (No 82)	82	10/26/2023	8:30	56.2%	69.2	59.78	52.9	0.200
Room N (No 83)	83	10/26/2023	8:35	62.5%	71.7	72.31	58.1	0.240

**APPENDIX B**  
**Sample Diagram**

