UL MCV 1491

Methodology for Marketing Claim Verification: UL Verified Healthy Building – Fire Stations

1

UL MCV 1491
Methodology for Marketing Claim Verification: UL Verified Healthy Building – Fire Stations

First Edition

May 27, 2022

TABLE OF CONTENTS

1.0 PURPOSE

The purpose of this document is to define the program for the UL Verified Healthy Building Mark for Fire Stations.

This verification claim focuses on the evaluation of indoor air quality within a Fire Station, for identification as a 'Verified Healthy Fire Station'.

2.0 SCOPE

The "Verified Healthy Fire Station" mark is defined as performance achievement for the Indoor Air Quality areas, as well as confirmation of the presence of all listed policies/plans described in Section 5.0 of this document. Additional sampling can also be conducted as a supplement to the verification mark.

This verified facility mark is supported by on-site quantitative measurements, visual inspections, validation of existing plans or policies, and by annual on-site inspection.

This verification program recognizes the issues surrounding lead paint, PCBs, asbestos, airborne mold, and other hazardous materials as they pertain to the built environment. Due to differing legal restrictions and licensure requirements, these contaminants are beyond the scope of this verification mark. It is the responsibility of the building owner and/or operator to assure compliance with all regulations applicable within the jurisdiction.

3.0 DEFINITIONS

- ACH - Air changes per hour with outdoor (fresh) air.
- AIR TEMPERATURE, DRY BULB (Tdb)- Temperature of air as measured independently of humidity effects (temperature).
- AIR TEMPERATURE, DEW POINT (Tdp) - Temperature at which condensation (dew) will form from water vapor in the air.
- ASSESSMENT - The multicomponent process of evaluating a building interior for Indoor Air Quality (IAQ) or Indoor Environmental Quality (IEQ).
- BREEAM – Building Research Establishment Environmental Assessment Methodology
- BUILDING ENCLOSURE (OR ENVELOPE) - Materials, components and assemblies that separate the interior of a building from the external environment (collectively the assemblies that make up the walls, roof, and bottom of a building).
- CARBON DIOXIDE – a greenhouse gas and byproduct of human respiration. In IAQ, carbon dioxide serves as a metric that can be evaluated as a proxy for ventilation or air exchange.
- COUNT CONCENTRATION (PM) - The number of particles per volume of air (#/cm3 or #/m3)
- DEW POINT - See AIR TEMPERATURE (DEW POINT).

- FILTER – A porous component of the HVAC system designed to remove particulate or gaseous pollutants from the air
- FORMALDEHYDE – a ubiquitous volatile organic compound sourced to building construction materials and household products
- GRESB – Global Real Estate Sustainability Benchmark
- HEATING VENTILATION and AIR CONDITIONING (HVAC) – Refers to building mechanical equipment to provide thermal comfort, acceptable IAQ including ventilation, and the maintenance of pressure relationships.
- INDOOR AIR QUALITY (IAQ) - The quality of air in building interiors. IAQ is generally deemed acceptable if air pollutants are absent or the concentrations of pollutants are too low to cause dissatisfaction or discomfort. Identification and characterization of relevant levels of indoor pollutants continues to develop.
- INDOOR EVIRONMENTAL QUALITY (IEQ) – The quality of environmental parameters in building interiors, including air, water, light, acoustics, and building hygiene. IEQ is deemed acceptable if quantitative performance measurements meet set thresholds such as contaminant loads for air and water quality, and performance outputs for lighting, acoustics, and building hygiene.
- INTERIOR - A space within a building intended for human occupancy
- IVOC - Individual volatile organic compound, sometimes referred to as speciated VOCs.
- LEED – Leadership in Energy and Environmental Design
- MASS CONCENTRATION (PM) - the mass of particles per volume of air (µg/m3)
- MERV – Minimum Efficiency Report Value, a measurement scale to rate the effectiveness of air filters (ASHRAE). Ranging from 1 – 20.
- OCCUPIABLE SPACE – any finished interior space fit for lease/occupancy
- OZONE (O_3) - a colorless unstable toxic gas with a pungent odor and powerful oxidizing properties, formed from oxygen by electrical discharges or ultraviolet light. It differs from normal oxygen (O_2) in having three atoms in its molecule (O3).
- RESPIRABLE SUSPENDED PARTICULATE (RSP) – Particulate matter suspended in air has an aerodynamic diameter less than 10 micrometers in diameter (PM 10). PM 2.5 (particulate matter less than 2.5 micrometers in diameter) are considered fine inhalable particulate and a greater risk to human health.
- RELATIVE HUMIDITY (RH) – the ratio of the amount of moisture in air compared to what the air can "hold" at a given temperature (%)
- SORBENT - Material that will reversibly adsorb Volatile Organic Compounds (VOCs) from air.
- TVOC - Total volatile organic compounds. The estimated sum value of all volatile organic compounds within the C6 to C16 range as measured by GC/MS techniques such as EPA

method TO-17 or ASTM D 6196. <<ISO16000-6>> Direct reading instruments also estimate TVOC concentrations using Photo Ionization Detection (PID) technology.

- UL Verification Program – Science based testing and surveillance program that verifies a marketing or performance claim for a given product or process. For this program, the performance claims are focused on indoor environmental quality metrics at the facility level.
- VERIFIED FACILITY - Refers to either an entire building or the portion of the building that is included within the scope of assessment and certification.
- VOLATILE ORGANIC COMPOUND (VOC) - Any carbon containing compound whose composition makes it possible to evaporate under normal atmospheric conditions of temperature and pressure. With specific regard to IAQ, this refers to C6 - C16 compounds that can be measured by GC/MS techniques such as EPA method TO-17 or ASTM D 6196.
- WELL – Certification program for the International WELL Building Institute

4.0 RESPONSIBILITY

UL Solutions Approved Personnel will perform Indoor Environmental Quality testing, observations, and verifications annually to support the verification mark claim.

4.1 Period

Verification Mark Claim use authorization expires [1 year] after the original Mark issuance date. The mark can be used and maintained throughout the year, provided that continuous monitoring or bi-annual site visit results meet threshold values defined in this program, and any corrective action narratives (if required) are completed[1]. Clients have the option to reevaluate their Claim via the Inspection Criteria and Surveillance Program outlined below.

4.2 Reevaluation Test/Audit/Inspection Criteria

After the initial verification mark, the following schedules for reinspections and evaluations will be completed on an ongoing basis.

- An Annual Reevaluation Inspection with all the parameters included for performance testing, visual observations and verification shall be completed for the annual award of the Verification mark

4.3 Non-compliance Actions (Surveillance)

For items where performance is not verified to the thresholds and requirements defined herein, the following corrective action will be necessary. Failure to document corrective action as needed may result in rescinding of the Verification Mark and removal from the Verify.UL.com database.

- Quantitative Metrics: Sampling results are required to be in compliance with thresholds set in this document for the Verification Mark as follows:
    - Air: Provided that 90% of the tested locations have met the performance criteria, a failure for a key metric is temporarily acceptable with an approved corrective action plan and/or explanation. However, verification may be held if two consecutive failures occur at the same sampling location until all performance levels are tested below the thresholds. If less than 90% of the tested locations have met the performance criteria, retesting is required. Note that a 100% compliance is required for BTEX and PAH criteria, as referenced in Appendix C.

- Qualitative metrics: Any necessary corrective action associated with visual observations, building or mechanical systems should be submitted by the responsible person documenting the corrective action with photographs where appropriate and verified through visual observation at the next site visit.

[1] The timeline from the issuance of the verification mark is subject to a 1 year requirement for re-verification. There is a 60-day grace period for the annual re-verification to allow for scheduling site visits and any lab or data processing turnaround times.

5.0 GENERAL REQUIREMENTS

All testing will be completed at the facility by UL Solutions approved personnel. Sampling data will be collected and analyzed using the methods shown in the tables that follow and compared with the defined thresholds.

Where available, the following general facility information will be provided prior to site visit and/or verified or collected during the on-site inspection:

- Building configuration and size.
- Renovation details.
- Special use areas such as gyms, kitchens.
- Air handling unit type, design, and operation.
- Building exhaust and return fan operation and fan tracking system.
- Heating and cooling system type and operation.
- Economizer system type, operational parameters, and other energy management device details.
- Filtration type and maintenance program.
- Air supply system operation and controls, including VAV zoning, regulation, and sequencing.
- Humidification type and control details, if present.
- Chemicals use and storage.
- Building materials that may affect the indoor air quality.
- Assessment of surrounding grounds and outdoor features that may impact IAQ

In addition to general information and sampling in the key areas defined in section 5.1, the UL Solutions team will confirm with the responsible person the presence of a list of maintenance and management policies (listed below). UL Solutions' goal for this verification of this section is to confirm the presence of each policy. Additionally, it is recommended that all policies contain appropriate sections for continuous improvement and management. If a project is pursuing the Verification Mark in tandem with complementary rating systems such as LEED, BREEAM In-Use, WELL, Fitwel, or others – it is recommended that these policies align with the requirements therein in concert with the Verification Mark review.

Each policy should be comprehensive for continuous improvement, including the following components:

Policy components:

1. Goals statement (what is covered and why)
2. Responsible Person (include additional vendor contact info if applicable)
3. Timeframe for policy (what dates is it valid for, and when was the most recent version adopted)
4. Scope of work (details)
5. Quality Assurance Process (i.e. - maintenance logs are kept on record, etc.)
6. Documentation of staff training where necessary

List of required policies:

- Asbestos Operations and Management Plan (if known asbestos present and in accordance with local, state and/or regional regulations)
- NFPA Standard 96* – Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations
- NFPA Standard 1500* – Standard on Fire Department Occupational Safety, Health and Wellness Program
- NFPA Standard 1581* – Standard on Fire Department Infection Control Program
- Standard Operating Procedure* for prevention and mitigation of fire-fighters exposure to contaminations.
- **Note: this verification mark only reviews if an Authorities Having Jurisdiction (AHJ) or NFPA standard has been addressed at the facility and does not attempt to verify or confirm compliance with any local/state/federal standards specific to fire stations.*

5.1 Air Quality

Parameter	Threshold	Testing Process	Testing Specifics	Referenced for Threshold Value
CO_2	700 ppm above outdoor levels (with upper limit of 1100)	handheld device, direct reading	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart)	ASHRAE 62 informative appendix
$PM_{2.5}$	15 µg/m^3; 25 µg/m^3 interim target used to determine if retesting is required * *for sampling within apparatus bays, the required threshold for the verification mark is to have indoor readings within a ± 5% range of outdoor air readings for this parameter*	handheld device, direct reading	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart)	WHO
TVOC	500 µg/m^3 Please reference APPENDIX C: Parameters for Air Sampling PAHs and BTEX for specific thresholds and more detail	handheld device, direct reading lab sampling	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart) Direct read sampling will be taken with a Photo Ionization Detector (PID) direct-read device.[2] At a minimum, one sample in the occupied/ living area and one in the apparatus bay will be completed via TO-17 (BTEX) sampling methodology. See	LEEDv4, WELLv1, Fitwel OSHA PELs

[2] If elevated readings are found, retesting will be required at a later date via lab sampling per TO-17 (or equivalent) in a minimum of 25% of locations with elevated readings

Parameter	Threshold	Testing Process	Testing Specifics	Referenced for Threshold Value
			Appendix C for Fire Station BTEX thresholds.	
Polycyclic Aromatic Hydrocarbons (PAHs)	Air sampling -0.2 mg/m3 (OSHA PEL) Please reference APPENDIX C: Parameters for Air Sampling PAHs and BTEX for specific thresholds and more detail	lab sampling	At a minimum, one sample in the occupied/ living area and one in the apparatus bay will be completed via PAH sampling methodology.	OSHA PELs
Temp	68-79°F * *for sampling within apparatus bays, the required threshold for the verification mark is to have indoor readings within a ± 5% range of outdoor air readings for this parameter*	handheld device, direct reading	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart)	ASHRAE 55
Humidity	<65% * *for sampling within apparatus bays, the required threshold for the verification mark is to have indoor readings within a ± 5% range of outdoor air readings for this parameter*	handheld device, direct reading	breathing zone (3-6' above finished floor), test 2 times per location (at least 60 minutes apart)	ASHRAE 62
Formaldehyde	0.08 ppm 8-hour TWA	handheld device, direct reading (lab sampling needed for noncompliance)	breathing zone (3-6' above finished floor), test 2 times per location (at least 60 minutes apart)	WHO

Parameter	Threshold	Testing Process	Testing Specifics	Referenced for Threshold Value
			Sampling will be taken with a direct-read device.[3]	
Ozone	51 ppb * *for sampling within apparatus bays, the required threshold for the verification mark is to have indoor readings within a ± 5% range of outdoor air readings for this parameter*	handheld device, direct reading	breathing zone (3-6' above finished floor), test 2 times per location (at least 60 minutes apart)	WHO
CO	3.5 ppm	handheld device, direct reading	breathing zone (3-6' above finished floor), test 2 times per location (at least 60 minutes apart)	WHO
NO_2	0.2 ppm 8-hour TWA	handheld device, direct reading	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart)	ACGIH
SO_2	0.25 ppm STEL	handheld device, direct reading	breathing zone (3-6 feet above finished floor), test 2 times per location (at least 60 minutes apart)	ACGIH
Building Pressurization	building entrances, transition zones, gyms, etc. are under positive pressure, all contaminant/pollutant sources are under negative pressure	smoke pen test or equivalent	at representative locations	ASHRAE 62

[3] If elevated readings are found, retesting will be required at a later date via lab sampling per ASTM D5197 (or equivalent) in a minimum of 25% of locations with elevated readings.

Parameter	Threshold	Testing Process	Testing Specifics	Referenced for Threshold Value
Mold and Moisture inspection	verification of no significant mold/moisture issues	visual inspection, thermal imagery and/or moisture meters	at representative locations	IICRC, EPA
Filter quality	MERV 13 (or highest possible). Proper filter fit and condition.	Visual inspection	If MERV 13 is not achievable due to system constraints and air quality parameters are achieved, a narrative explanation of system constraints is acceptable. A minimum of MERV 8 filtration is required for systems in the common/living areas.	ASHRAE 52.2
No Smoking policy	No smoking policy inside the building and within 25 feet of any openings or air intakes.	Visual inspection	Signage present at entrances and dedicated smoking areas, if present	Federal Management Regulation Amendment 2008-08
Sampling Methodology:	Test all common/living areas, apparatus bays + outdoor air sample (same protocols per indoor sampling locations, at least 60 minutes apart). A minimum of 4 samples will be taken, 2 of which are to include TO-17 (BTEX) and PAH sampling.			
Site Inspection:	- visual inspection of representative number of air handling units (ventilation, filtration, hygiene - including coils, condensate drainage, fan chambers, humidifiers, controlling hardware, etc.) - visual inspection of representative number of supply air diffusers and air intakes - visual inspection of ongoing construction renovations (if applicable) - visual inspection of the common/living areas and apparatus bays - visual inspection of separation distance from bay exhaust and outdoor air intakes -visual inspection if transitions zones are present -visual inspection if decontamination area is present -visual inspection if vehicle exhaust system is present			

5.2 The following records and tracking will be in place for all UL Solutions personnel and equipment:

a. Data Storage – how and where are records and data maintained

   i. Record keeping practices meet ISO 17025 intent, test results and records will be maintained for a period of 2 years after testing

b. Training Records – demonstrate how staff are qualified to conduct the testing

c. Calibrations Records – in-house and factory calibrations will be performed and recorded for all associated equipment

d. Sample tracking system in place for lab sampling, when required:

   i. The laboratory shall have procedure for the transportation, receipt, handling, protection, storage, retention and/or disposal of test items, including all provisions necessary to protect the integrity of the test item.

6.0 TESTING LOCATIONS

See tables above for testing location definition in each parameter set.

7.0 AGREEMENTS

It is the participant's contractual responsibility to notify UL Solutions of any changes made to their facilities and staff that may influence the testing performed under this Program.

It is the participant's responsibility to respond to policy confirmations and data requests truthfully, and representative of typical facility operations.

8.0 PROGRAM INACTIVATION

For items where performance is not verified to the thresholds and requirements defined herein, corrective action will be necessary as determined by guidelines outlined in Sections 4.3 and 5 of this document. Failure to document corrective action as needed will result in rescinding of the Verification Mark and removal from the Verify.UL.com database.

9.0 RECORDS

All records to show compliance with this policy and associated procedures shall be stored and maintained by UL Solutions and by the test facilities. All records are maintained for a minimum of 2 years.

APPENDIX A: EQUIVALENCIES

This appendix includes International Equivalents for parameters that can be accepted in exceedance of set thresholds to support regional context only if parameters set in this document cannot already be met.

Other standards may be applied outside those listed below. Should your project feel there are additional regional exceptions applicable to your project, please communicate with your UL approved personnel completing the on-site inspections for further guidance.

China		
Contaminant/Condition	**Acceptable Limit**	**Reference**
PM2.5	75 µg/m^3	WHO 24Hr Interim target I
Ozone	75 ppb	US NAAQS
GB/T 18883. National Standard of the People's Republic of China: Indoor Air Quality Standard		
US EPA National Ambient Air Quality Standards http://www.epa.gov/air/criteria.htm		
GB 50325 National Standard of the People's Republic of China: Code for Indoor Environmental Pollution Control (Table 6.0.4) I		

UAE		
Contaminant/Condition	**Acceptable Limit**	**Reference**
Formaldehyde	80 ppb	Dubai Regulations
TVOC	300 µg/m^3	Dubai Regulations
CO2	800 ppm	Dubai Regulations
The Green Building Regulations and Specifications in the Emirate of Dubai		

India		
Contaminant/Condition	**Acceptable Limit**	**Reference**
PM2.5	40 µg/m^3	NAAQS India
National Ambient Air Quality Standards of India		

Filter Rating Equivalency Chart

<table>
<tr><th colspan="6">MERV Rating Equivalency Table</th></tr>
<tr><th>MERV Rating / ASHRAE 52.2</th><th>EN 779</th><th>ISO 16890 ePM1</th><th>ISO 16890 ePM2.5</th><th>ISO 16890 ePM10</th><th>ISO 16890 Coarse</th></tr>
<tr><td>5</td><td>G3</td><td rowspan="6">NA</td><td rowspan="4">NA</td><td rowspan="2">NA</td><td>>80%</td></tr>
<tr><td>6</td><td rowspan="2">G4</td><td rowspan="2">>90%</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td rowspan="2">M5</td><td rowspan="2">>50%</td><td rowspan="6">NA</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td rowspan="3">M6</td><td rowspan="3">50-65%</td><td rowspan="3">>60%</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>F7</td><td>50-65%</td><td>65-80%</td><td>>85%</td></tr>
<tr><td>14</td><td>F8</td><td>65-80%</td><td>>80%</td><td>>90%</td></tr>
<tr><td>15</td><td>F9</td><td>>80%</td><td>>95%</td><td>>95%</td></tr>
</table>

APPENDIX B: ALIGNMENT

The Verified Healthy Building Mark is aligned with the following list of sustainability and health and wellness standards and intended to work in tandem with these and other formal programs. Please visit the Verification Mark website for more detailed information on alignment.

- LEED for Operations + Maintenance credits for Indoor Air Quality Testing
- WELL Features' Ongoing Monitoring requirements for Air and Thermal Comfort
- Fitwel credits for Indoor Air Quality testing
- WELL Health-Safety Feature requirements for Ongoing Air and Water Quality Monitoring and Mold and Moisture Management
- BREEAM In-Use issue for Air and Water Quality Assessments
- Indoor Environmental Quality assessments to support ENERGYSTAR certification, and
- Other alignments internationally

Specific to Fire Stations, there is a policy alignment with NFPA, as listed in Section 5.0

APPENDIX C: PARAMETERS FOR AIR SAMPLING PAHS AND BTEX

BTEX table for TO-17 VOC sampling thresholds

Parameter	Threshold	Testing Process	Testing Specifics	Reference for Threshold Value
TO-17 - Benzene	1 PPM (OSHA TWA) 0.1 PPM (NIOSH TWA) 0.5 PPM (ACGIH TLV)	Air sampling of representative areas throughout common/living areas and apparatus bays	Breathing zone (3-6' above finished floor)	OSHA
TO-17 - Ethylbenzene	100 PPM (OSHA TWA) 100 PPM (NIOSH TWA) 20 PPM (ACGIH TLV)			OSHA
TO-17 - Toluene	200 PPM (OSHA TWA) 100 PPM (NIOSH TWA) 20 PPM (ACGIH TLV)			OSHA
TO-17 - Xylenes (Total)	100 PPM (OSHA TWA) 100 PPM (NIOSH TWA) 100 PPM (ACGIH TLV)			OSHA

PAHs table for sampling thresholds

Parameter	Threshold	Testing Process	Testing Specifics	Reference for Threshold Value
PAH - Anthracene	0.2 mg/m^3 (OSHA TWA)	Air sampling of representative areas throughout the building and/or equipment	Breathing zone (3-6' above finished floor)	OSHA
PAH - Benz[a]anthracene	Suspect human carcinogen (ACGIH)			--
PAH - Benzo[b]fluoranthene	Suspect human carcinogen (ACGIH)			--
PAH -Benzo[a]pyrene	0.2 mg/m^3 (OSHA TWA) Suspect human carcinogen (ACGIH)			OSHA
PAH - Chrysene	0.2 mg/m^3 (OSHA TWA) Potential occupational carcinogen (NIOSH) Animal carcinogen (ACGIH)			OSHA
PAH - Naphthalene	10 PPM (OSHA TWA) 10 PPM (NIOSH TWA) 10 PPM (ACGIH TWA)			OSHA
PAH - Phenanthrene	0.2 mg/m^3 (OSHA TWA)			OSHA
PAH – Pyrene	0.2 mg/m^3 (OSHA TWA)			OSHA