Building Biology Indoor Environment Checklist©

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Land Salzburg

Für unser Land!

Berufsverband Deutscher Baubiologen e.V. VDB

The *Building Biology Indoor Environment Checklist*© contributes to creating optimal living and work environments that promote health and well-being for occupants, users and visitors.

Top performance of body and mind as well as optimal regeneration and relaxation require a healthy building that is largely free from undesirable environmental stressors.

The *Building Biology Indoor Environment Checklist*© is based on the current Standard of Building Biology Testing Methods (SBM-2003[1]), making possible the verification of environmental stressors through recognized testing methods. For the interpretation of test results, we recommend the Building Biology Guidelines for Sleeping Areas of the SBM-2003[1].

This checklist is created - to the best of our knowledge - as a tool for preventive health protection. We do not want to, nor can we, make any claim as to the completeness of the presented information not least because of the multitude of possibilities involved. This checklist is meant to provide initial guidance and encourage action towards healthy building. For in-depth advice on detailed questions and the implementation of solution options, consult a qualified building biology consultant.

The *Building Biology Indoor Environment Checklist*© serves as a guideline, which can be used in the planning and design stages of a new project as well as for existing buildings. The focus is on areas for long-term use, especially sleeping areas, resting spaces, classrooms and workplaces.

This *Building Biology Indoor Environment Checklist*© covers the following parameters according to the classification of the SBM-2003[1]:

- A 1 AC Electric Fields (ELF)
- A 2 AC Magnetic Fields (ELF)
- A 3 Radiofrequency Radiation (Electromagnetic Waves)
- A 4 Static Electric Fields (DC)
- A 5 Static Magnetic Fields (DC)

It is our intention to continue updating this checklist and also to develop recommendations for other parameters of the Standard of Building Biology Testing Methods.

The checklist was created by an interdisciplinary workgroup:

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[1] The Standard of Building Biology Testing Methods (SBM-2003) and the corresponding Building Biology Guidelines for Sleeping Areas of the SBM-2003 can be found at: http://www.baubiologie.de/site/downloads/english/SBM2003_engl_neu.pdf

A 1 AC Electric Fields (ELF)

Unfavorable Conditions	Solution Options
Unshielded (conventional) electric wiring.	Use electrically shielded wiring. Provide a demand switch for sleeping areas. Prior to installation, always have its effectiveness checked by potential-free measurements of the AC electric field. Depending on the wiring layout, the installation of a demand switch could also increase the electric-field exposure!
Unshielded electrical boxes.	Use shielded electrical boxes.
Unshielded connection cables with three-pin plug.	Use shielded connection cables, e.g. for computers, monitors, printers, scanners, consumer electronics devices, etc.
Devices with unshielded connection cables and European flat plugs.	Keep distance (e.g. place on a second table) and after use disconnect both poles directly at the outlet (e.g. with a switchable outlet or a disconnection switch).
Unshielded lamps and extension cords with three-pin plug.	Use shielded lamps such as desk lamps, bedside lamps, dining table lamps, floor lamps and ceiling lamps with appropriate shielded cords.
Fluorescent lamps and compact fluorescent lamps such as energy saving lamps.	Avoid exposure to any type of fluorescent lamp below 1 to 2 m (3 to 6') distance. More favorable are „normal" incandescent lamps with grounded metal socket and shade as well as line-voltage halogen lamps (Europe: 230 V; North America: 120 V) with grounded metal shade.
Unshielded extension cords.	Shielded extension cords.
Unshielded power outlet strips.	Shielded power outlet strips.
Ungrounded aluminum vapor barrier in occupied attic.	Have aluminum vapor barriers grounded by a licensed electrician if a reduction of the electric field can be achieved (check beforehand with potential-free measurements)
Electrically heated waterbeds.	Have the electric-field exposure tested. In case of an elevated exposure, only heat waterbed during the day and unplug during sleep (only switching off is often insufficient).
Electric blankets.	Preheat bed with electric blanket, but unplug during sleep (only switching off is often insufficient).
Computer monitors, laptops, printers, copiers, fax machines.	Use devices with TCO certification (www.tcodevelopment.com).
High-emission photovoltaic systems (due to the inverter's generation of extensive 50/60 Hz AC electric fields that are emitted from the PV modules).	The problem of photovoltaic systems with electronic inverters often consists in the photovoltaic modules "picking up" the 230 / 120 AC voltage and spreading the associated AC electric fields across large areas. Therefore use repercussion-free (ultra-clean) inverters whose AC voltage cannot backfeed into the PV modules; in addition sensitive areas for long-term use should be located away from PV modules, inverter and cables. Specify the quality requirements prior to the allocation of the contract.

A 2 AC Magnetic Fields (ELF)

Unfavorable Conditions	Solution Options
Net/stray currents on grounding conductors, ground bus bars, metal water piping, gas piping, etc.	Install a TN-S power system, strictly separating the grounding and the neutral conductor throughout the entire installation; only one single bond at the main ground bus bar.
Net/stray currents on shielding of data cables (LAN cable).	Verified by measurements, ground shielding on one side only, e.g. use patch cable without a metal jack at the computer end. Install a TN-S power system, strictly separating the grounding and the neutral conductor throughout the entire installation; only one single bond at the main ground bus bar.
Asymmetrical load distribution.	In three-phase systems, have a licensed electrician balance the phases in such a way that a largely symmetrical load distribution is achieved.
Net/stray currents that enter the building along metal components (Europe: 50 Hz/North America 60 Hz from the electric power distribution system or 16 2/3 Hz from the railway system).	Install a dielectric coupling (electrically insulating piece) after having it checked by a licensed electrician. In some instances all electrically conductive piping and systems including shielding of cables should be connected where entering the building, i.e. an equipotential bonding is carried out right there.
Currents with harmonics (resulting in field emissions with frequencies well above 50/60 Hz).	Avoid nonlinear electronic devices such as energy saving lamps, electronic ballasts (for fluorescent lamps), dimmer switches, mains adaptors. Reduce the number of electronic devices by choosing multifunction devices (e.g. printer, fax machine, scanner and copier in one device). Generous sizing of the cross section of neutral conductors.
Rest/sleeping areas or workplaces in the immediate vicinity of the feeder cable to the building, service meter, main panel and distribution cables of electric circuits.	Keep sufficient distance to feeder cables to the building, service meters, main panels and distribution cables of electric circuits. If in doubt, have it checked by an expert.
Nearby overhead and underground high-tension power lines.	Keep sufficient distance to overhead or underground high-tension power lines (record data of long-term measurements or measure at a time of known load conditions and calculate to thermal threshold current).
Railway systems and stray currents of railway systems.	Keep sufficient distance to the railway system and eliminate stray currents; e.g. by using piping made from electrically insulating materials or a dielectric coupling (electrically insulating piece). In some instances all electrically conductive piping and systems including shielding of cables should be connected where entering the building, i.e. an equipotential bonding is carried out right there.
Transformer stations and substations (including pole-mounted/ground-mounted transformers).	Keep sufficient distance to transformers and especially to secondary distribution power lines (record data of long-term measurements or measure at a time of known load conditions and calculate to thermal threshold current).

Unfavorable Conditions	Solution Options
Single-phase electric motors such as: - Compressor refrigeration units - Aquarium pumps - Electric clocks (e.g. in electric stoves or as timer) - Machine motors	Keep sufficient distance and/or use absorber refrigeration units instead of compressor units.
Small transformers (lamp transformers, clock radios, CD players, rechargers, electric typewriters, electric calculators, etc.).	Keep sufficient distance.
High-emission low-voltage halogen lamps (12 V), installed as rope lighting with large distance between supply and return cable.	If low-voltage halogen lamps are required, choose track lighting installation with a short distance between supply and return cable; better are installations with line-voltage halogen lamps (230 / 120 V).
Computer monitors, laptops, printers, copiers, fax machines.	Use devices with TCO certification (www.tcodevelopment.com).
High-emission headsets and telephone receivers.	Use low-emission headsets and telephone receivers (e.g. shielded or based on piezo technology).

A 3 Radiofrequency Radiation (Electromagnetic Waves)

Unfavorable Conditions	Solution Options
Relevant emissions from mobile phone base stations (GSM, GPRS, PCS, US Cellular, UMTS, cdmaOne, CDMA 2000, TETRA).	At the source: „Mobile Phone Network Light“. Provide evidence for low RF exposure by calculation including visualization, e.g. with NIRView software (www.nirview.com), and measurement. At the moment there are no legal requirements to minimize emissions, rather on a voluntary basis. At the building: Installation of RF attenuating building and shielding materials.
DECT cordless phones (2.4-GHz/5.8-GHz) (base stations constantly emit pulsed radiation).	Use corded phones. If cordless phone technology is necessary, choose non-pulsed cordless phone technologies: CT1 (in Austria), CT1+ (in Germany and Switzerland) or analog 800/900 MHz without DSS (North America); keep cordless phone calls as short and infrequent as possible.
WLAN (Wireless Local Area Network; access points and client devices, searching for an – often non-existent – access point, are permanent transmitters of pulsed RF radiation).	WLAN is not recommended. Instead use wired internet access (modem, ISDN, DSL). If WLAN technology is indispensable, always turn access points and client devices off when not in use.
Bluetooth applications.	Do not use Bluetooth applications. If technically necessary, choose devices with the lowest possible power output, e.g. 1 mW (class 3) or 2.5 mW (class 2); avoid 100 mW power output (class 1). When not in use, turn off.
Mobile phones (GSM, GPRS, PCS, US Cellular, UMTS, cdmaOne, CDMA 2000).	Use landlines. Corded phones for undisturbed conversations should also be provided in public areas. If needed, use mobile phones for important and urgent short calls or SMS only.

Unfavorable Conditions	Solution Options
Relevant emissions from radio, TV and radar stations, etc.	At the building: Use RF attenuating building and shielding materials.
Microwave ovens.	Do not use microwave ovens. If necessary, be aware of radiation leakage: Keep 1 to 2 m distance while operating.
Wireless baby monitors and cameras, especially with DECT standard.	Do not install wireless baby monitors; instead choose devices that use the corded telephone network or plug into a power outlet (powerline communication). Use baby monitors based on sound only (i.e. activated by noise only).
Computer monitors, laptops, printers, copiers and fax machines.	Use devices with TCO certification (www.tcodevelopment.com).
Wireless computer mice and keyboards.	Use corded computer mice and keyboards.

A 4 Static Electric Fields (DC)

Unfavorable Conditions	Solution Options
Synthetic carpets / wall-to-wall carpeting.	Carpets from plant-based natural fibers without insulating backings and without biocides or mothproofing agents.
Synthetic drapes.	Drapes from plant-based natural fibers (e.g. cotton, linen). Animal fibers (wool, silk) may become electrostatically charged. For regulated occupancies (more stringent fire safety regulations) drapes from Trevira CS can be an option (www.treviracs.de).
Synthetic wallpapers (e.g. vinyl).	Wallpapers made from natural materials (e.g. cellulose, cotton).
Varnish (petroleum-based) or synthetic surfaces.	Natural finishes and surfaces (e.g. wood, natural stone, silicate paint).
Plastic casters under office chairs.	Antistatic casters.
Stuffed animals with synthetic furs.	Materials that cannot become electrostatically charged.
Relative air humidity < 40 %.	Relative air humidity 40 % to 60 %.

A 5 Static Magnetic Fields (DC)

Unfavorable Conditions	Solution Options
Magnetized steel in beds such as metal brackets for adjustable head/footboards, metal grills, metal bed frame.	Wood (if necessary small aluminum or stainless steel brackets can be used)
Magnetized steel in mattresses such as coil springs.	Metal-free mattresses from natural materials: Pure natural latex, kapok, horsehair.
Magnetized steel trusses and steel reinforcement in concrete.	Keep sufficient distance to areas for long-term use or demagnetize.
Magnetized steel radiators, steel frames and doors, steel bathtubs, steel tanks.	Keep sufficient distance to areas for long-term use or demagnetize.
Magnetized steel desks.	Use wood instead or demagnetize.