

12 Chemical exposure

Health complaints arising in indoor workplaces are often felt to be directly linked to the presence of harmful substances in the air. Typical examples of this are formaldehyde and wood preservatives.

Odour (see Chapter 4), acute complaints, results of medical examinations and press reports, for example, can point to the presence of hazardous substances or cause their presence to be suspected. However, they do not constitute actual evidence of their presence.

In such cases, appropriate investigations (Section 12.1) must be carried out to determine whether there are any grounds to suspect exposure to hazardous substances before conducting hazardous substance measurements, which usually entail significant technical and staffing effort. Frequently, the findings of such investigations enable decisions to be made as to the necessary measures (e.g. redevelopment) without hazardous substance measurements having to be performed.

The action to be taken must be decided on the basis of the findings. If the suspected exposure to hazardous substances cannot be confirmed, other causes for the complaints must be sought. However, if the initial suspicion (i.e. the suspected presence of hazardous substances in the workplace air) is confirmed, specific hazardous substance measurements can take place, as described in Section 12.2, based on the findings of the investigation.

Section 12.3 provides general advice on how to assess measurement results. Information on specific substances and categories of substance is given in Section 12.4.

12.1 General guidance on investigating chemical exposures

U. Bagschik, Düsseldorf
J. Fauss, Mannheim
H. Fröhlich, Mannheim
K. Pohl, Mainz

The potential sources of indoor air pollution are manifold. Table 24 shows possible sources and the most important substances they emit. Further information can also be found in Section 6.4, “Materials”, among other places. The questionnaires on building design and decoration of rooms (S5) and procedures for cleaning of buildings (S6), which deal with the matters covered in Section 6.4, are available on the internet (www.dguv.de, webcode 650356), and are also useful tools for this investigation.

Section 12.4 provides substance-specific information. A table showing frequently detected substances and their possible sources is presented in Annex 5.

Table 24:
Sources of indoor air pollution and the most important substances they emit, based on DIN EN ISO 16000, Part 1 [1]

Source/cause	Process/activity	Products used, more precise definition of source	Substances emitted
Biological sources			
E.g. humans, animals, insects, mites	Breathing		Carbon dioxide, water vapour, naturally occurring odorant substances, odorant substances from foodstuffs
	Perspiration		Water vapour, odorant substances
	Digestion, excretion		E.g. bowel gases, odorant substances, excrements, decomposition products
	Hair loss, shedding of skin		E.g. bowel gases, odorant substances, excrements, decomposition products
Indoor plants	Transpiration, mould infestation	Substrate	Terpenes and other odorant substances, water vapour, microbial VOCs
Building sources			
Building structure and materials	Product processing, outgassing, ageing, abrasion, decomposition, mould infestation	Construction materials, building protection and anti-corrosion products, insulating materials, sealant materials, paints, concrete admixtures	Gaseous and particulate substances, e.g. solvents, plasticisers, wood preservatives, flame retardants, fibres (asbestos, mineral wool), radon (e.g. from granite), amines, ammonia, microbial VOCs
Ventilation and air conditioning systems	Operation and maintenance	Washers, filters, insulation and sealant materials, deposits, heat exchangers	Dust, fibres, biocides, odorant substances

Source/cause	Process/activity	Products used, more precise definition of source	Substances emitted
Building sources			
Furniture and furnishings	Product processing, decoration, outgassing	Furniture, floor coverings, home textiles, varnishes and paints, wall-paper	Monomers and oligomers from plastics, resins, surface coatings, adhesives (e.g. formaldehyde); fibres, solvents, plasticisers, stabilisers, biocides (e.g. pyrethroids)
Indoor activities			
Use as office	Office work	Office items, IT equipment, copiers	Organic solvents, semi-volatile organic substances (plasticisers, flame retardants), toner ingredients, ozone
Hygiene and personal care products	Personal care, cosmetic treatments	Personal care products and articles of daily use	Solvents, propellants, perfumes, inorganic and organic aerosols (colouring agents, pigments, varnishes, resins), haloforms
Room cleaning	Cleaning and furniture care; pest control	Washing and cleaning agents, polishes, disinfectants, pest control products	Water, ammonia, chlorine, organic solvents (e.g. ethanol), bactericides (formaldehyde), insecticides (organophosphates, pyrethroids, carbamates) and chlorine compounds; house dust
Cooling and heating	Combustion processes (heating, cooking), use of open fire (e.g. including candles)	Coal, heating oil, gas, wood, food-stuffs	Gas (town gas, bottled gas, natural gas), heating oil vapour, carbon dioxide, carbon monoxide, water vapour, suspended particulate matter, hydrocarbons and many other organic substances (combustion products and char)
Outdoor air			
Emissions from human activity	Ventilation, infiltration and diffusion through the building envelope	Industrial enterprises, transport, domestic heating, agriculture, outdoor fires, landfills, contaminated waste	Inorganic and organic gases and aerosols (e.g. solvents, ammonia, odorant substances, polycyclic aromatic hydrocarbons)
Biogenic and geogenic emissions	Ventilation, soil air penetration, dust raising	Plants in bloom, uranium deposits in the earth, sea spray, soil resuspension, natural rotting	Pollen, radon, methane and other volatile organic compounds (hydrocarbons, organohalogen compounds), odorant substances, dusts, sea salt
Living organisms	Excretion	Bowel gases, odorant substances, excrements, decomposition products	Ammonia and sulphur compounds

Reference

- [1] DIN EN ISO 16000-1: Innenraumluftverunreinigungen – Teil 1: Allgemeine Aspekte der Probenahmestrategie (06.06). Beuth, Berlin 2006

12.2 Measurement of chemical exposures

D. Breuer, Sankt Augustin
Y. Giesen, Sankt Augustin
H.-D. Neumann, Düsseldorf
S. Peters, Sankt Augustin

Continuous pollutant monitoring, as practised in industrial workplaces, is usually not possible in indoor workplaces. On-site measurements should be conducted using easy-to-handle devices that cause little disruption to the workflow. Indoor pollutants have numerous sources (cf. Section 12.1), whose emission characteristics differ significantly. There are

- continuous sources, which can emit pollutants over a long period (e.g. building materials or furnishings), and
- intermittent sources, which can cause short-term peak exposure to pollutants (e.g. cleaning agents and, in the past, tobacco smoke).