

Draft Technical Annex: A review of models and methods for estimating concentrations of pollutants inside buildings that arise as a consequence of concentrations in air outside the building

As pollutants are dispersed in the atmosphere by wind advection and diffusion they may impact on buildings and infiltrate into internal spaces. This infiltration may arise passively through fissures in building materials or through open windows or by mechanical means through forced ventilation systems. As a consequence air and surfaces within the building may become contaminated.

ADMLC is interested in reviewing models and methods for estimating concentrations of pollutants inside buildings, in air and on internal surfaces, that arise as a consequence of concentrations in air outside the building. ADMLC previously funded work in this area in 1996 <http://admlc.org.uk/documents/r302.pdf> and is now interested in reviewing developments since this time. The committee is aware of work being carried out in this area by Centre for the Protection of National Infrastructure (CPNI), Dstl and Home Office.

It is not uncommon for indoor concentrations in air to be estimated using simple ratios where the air concentration indoors is assumed to be in equilibrium with the air outside. This may be a reasonable assumption for some situations but is likely to depend on the type of building and its construction, ventilation mechanisms and the duration of the release. This approach also often assumes that the air concentration is uniform around the building which in many situations is unlikely to be true. For example modelling dispersion in street canyons has shown that high pressures may be exerted at some locations on building surfaces that may lead to high indoor concentrations.

For this review ADMLC are primarily interested in releases of hazardous materials over relatively short periods of time rather than continuous releases. The review should therefore concentrate on scenarios where pollutants outside the building are only present for short periods of time (up to 24 hours) and from a single source. For such scenarios details of the time dependence of the build-up and decay of pollutant levels indoors and the key factors affecting these changes are of particular interest. However, the possibility of developing some rules of thumb to estimate levels of air concentrations indoors should also be investigated

Once pollutants have penetrated a building they are then likely to be dispersed throughout the building at various rates and to deposit on internal surfaces. Future resuspension may also give rise to an inhalation hazard.

The review should consider a range of models, their availability, input data requirements, ease of use and general strengths and weaknesses. Key parameters in such assessments should be identified and their importance, in terms of sensitivity of results, should be considered. Some specific parameters to consider include:

- Outdoor air concentration at the building surface as a function of location and time.
- Meteorological conditions outdoors (eg wind speed, rainfall rate, temperature)
- Environmental conditions inside the building (eg humidity, temperature)
- Pressure over building surface as a function of location and time
- Building materials
- Ventilation rates
- Air exchange rates (indoor/outdoor, room to room)
- Pollutant type, particle size, reactivity
- Values of typical equilibrium concentration ratios between indoors and outdoors and when it is appropriate to apply these.