

Radiochemical indoor environment and public health risks in current building technologies

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Development of building technologies is tightly connected to energy saving demands of growing population, and significant problems with waste and economy fragility

Building sector:

- tries to be selfsustainable, balancing between profit, social trends like fashion, need for higher living standard and rasing awareness of irreversible nature destruction
- adopts new technologies and materials which brought large improvement in obeying all these demands but at the same time, a new complex indoor radiochemical environment is being produced that way

- Elimination of waste such as fly ash, by its incorporation in concrete is significant from the ecological viewpoint, but it may cause increased indoor emissions of ionizing radiation due to the fact that it may contain high levels of radioisotopes:

uranium (^{235}U , ^{238}U),

radium (^{226}Ra),

thorium (^{232}Th),

lead (^{210}Pb),

polonium (^{210}Po)

potassium (^{40}K)

- Exposure to ionizing radiation may be increased additionally to indoor radon, by usage of zirconium and granite as fashionable elements of indoor finishing



Finishing indoor materials contain

- nano particles,
- flame retardants,
- different organic compounds
- ammonia
- wood preservers



- combined with ionizing radiation may produce very complex health effects on occupants, especially on children and possible transplacental effects on fetal development
- Biological effects caused by indoor environment may be modified by diet quality and could be gender related

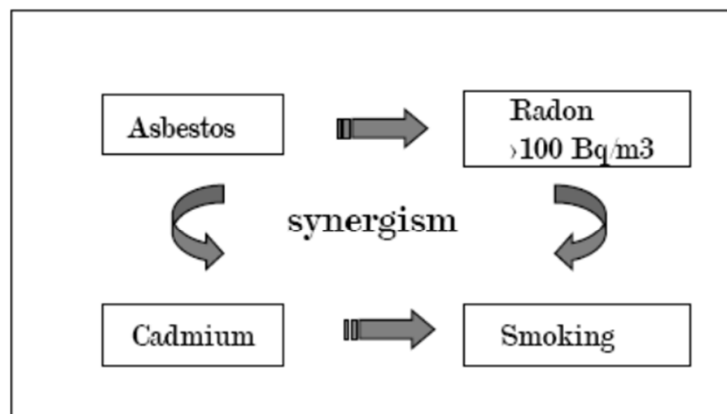
Indoor exposures interact with environmental settings and behaviour

- Industry zone
- Traditional heating
- Traffic (highways, crossroads)
- Smoking habit



Complex biological effects which demand solutions from interdisciplinary teams:

- Lung cancer, allergy, asthma, endocrine disruption mostly related with indoor exposure
- For some diseases unknown impact of new building materials due to long latency period
- For some agents such as nano particles which pass blood-brain barrier extremely limited data on biological effects are available
- Wood preservers such as chromated copper arsenate which are genotoxic and fetotoxic are suggested to be switched with azoles which are endocrine disruptors



- estrogene like mechanisms
- pesticides
 - heavy metals: Cd, Pb, Ni, Cr, As
 - dioxin
 - PAH
 - molds

Outdoor air pollution
SO₂, NO₂, NO, O₃

INDOOR EXPOSOME

PM_{2.5} and PM₁₀ particles

(cell receptors, DNA adducts, glycan modification, methylation, aneuploidy, DNA damage)

- smoking**
methylnitrosamino-pyridyl-butanone, cotinine, heavy metals, polonium
- cooking oil fumes**
heterocyclic amines
- concrete additives** - ammonia, etc
- nano particles** - metals, silicon

- VOCs** toluene, xylene, benzene, styrene
- non-ionizing radiation:**
microwave ovens
cell telephone
- wood preservers:**
Arsenic, Chromium, azoles
(aromatase inhibitors)

Suggested administrative solution:

- Introduction of building control procedures which will include measurements of indoor radiochemical emissions could improve life standards and enable enforcement of politics in which occupants have option to select residence with healthy indoor environment
- Building construction sector can be stimulated to follow such politics via tax relief system.



