A blue-tinted photograph of a residential street. The street is lined with multi-story buildings and several cars are parked along the side. The perspective is looking down the street, which recedes into the distance. The overall tone is monochromatic blue.

# Sustainable Efficient Homes and Indoor Air Quality

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# Changes are coming

- Changes are here and more are on the way
- High price of fossil based fuels
- Commitment to reduce CO<sub>2</sub> emissions

# High fuel costs can mean:

- we end up with more excessively cold homes, or
- more homes in fuel poverty, or
- we use fuel more efficiently

## Latter case:

- we use more efficient means of heating homes
- and, we insulate to a much higher degree

# Ventilation heat loss

- Very high proportion of heat lost through ventilation
- not to current Building Reg. Standard - about 1 ac/h
- to moderately tight building - about 0.35 ac/h

# Example

- Two storey house, quite well insulated  
125m<sup>2</sup> floor area, total heat loss at 22c  
temp difference and 1 ac/h - total heat  
loss = 5.57kw/h
- Same property with ventilation reduced  
to 0.35 ac/h - 3.68 kw/h
- 35% less heat loss

# Potential outcome

- Seems like a good return for comparatively little effort
- Risk is going from colder well ventilated, to warm and poorly ventilated

# What we commonly do

- Replace old draughty windows and doors
- Seal up common sources of air leakage

# What we commonly end up with



# Additional problems:

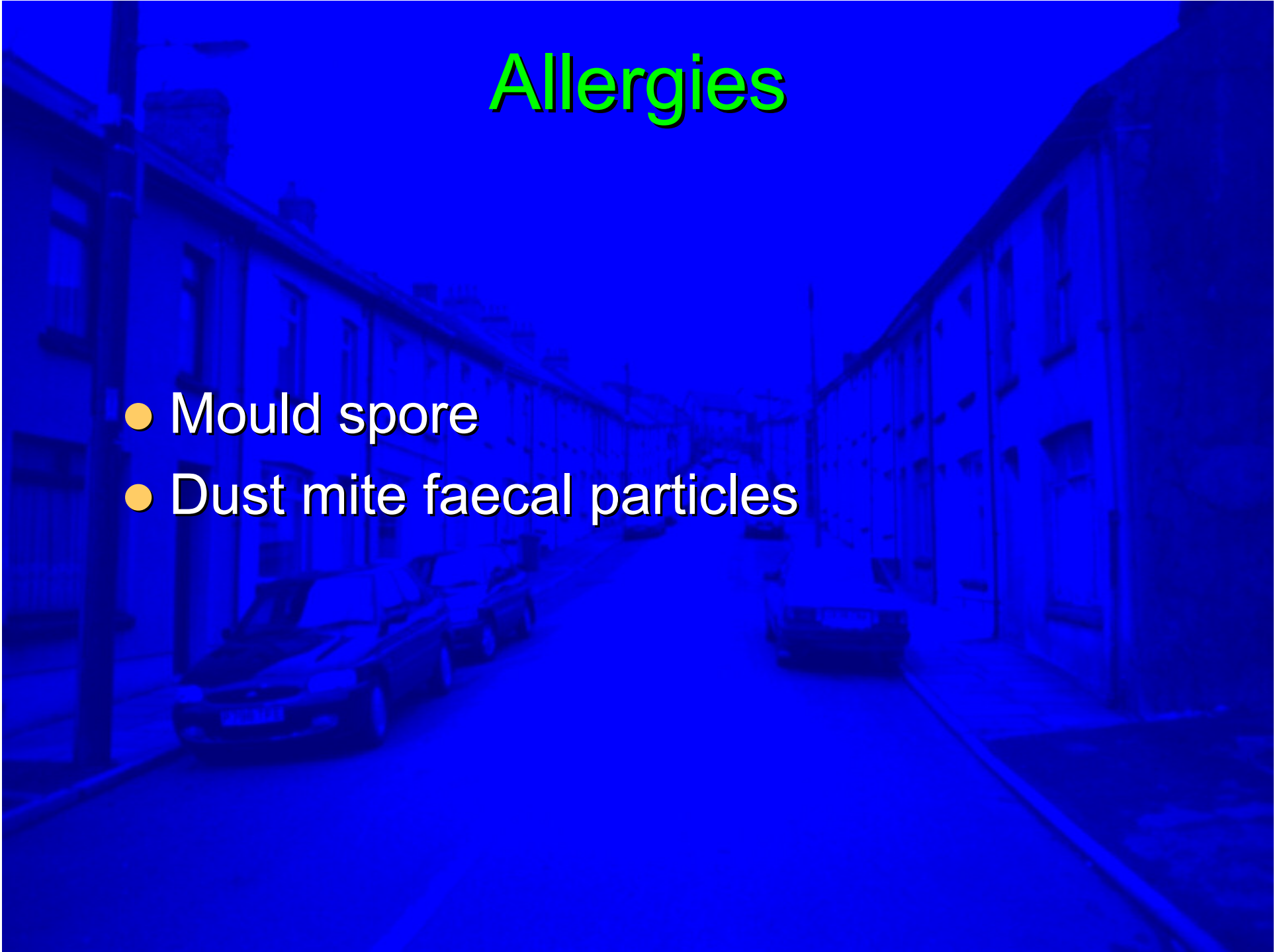
- NO<sub>2</sub>
- VOCs
- Radon
- Increase in dust mite populations

# Allergies



# Allergies

- Mould spore
- Dust mite faecal particles



**Table 1** Experimental results for DP population growth at different combinations of T and RH

Temperature degC	Population at start no. mites mean of 3 replicates	RH %	Population after 21 days		Multiplication factor
			no. mites mean of 3 replicates	<i>standard deviation</i>	
15	776	33.4	130	121	0.17
	795	46.2	116	128	0.15
	799	63.0	656	208	0.82
	794	66.0	754	213	0.95
	794	75.0	633	201	0.80
	781	87.0	763	402	0.98
20	1,157	32.4	183	65	0.16
	1,171	46.0	385	153	0.33
	1,153	68.5	6,389	541	5.54
	1,142	82.0	7,265	660	6.36
	1,129	84.4	8,864	1,266	7.85
	1,147	85.6	7,479	1,218	6.52
25	1,156	34.4	0		-
	1,141	50.4	0		-
	1,177	66.6	9,264	373	7.87
	1,181	68.6	8,408	508	7.12
	1,177	85.4	15,029	1,758	12.77
30	1,196	40.6	0		-
	1,184	53.3	0		-
	1,167	69.8	9,705	3,173	8.32
	1,113	86.6	21,659	2,583	19.46
	1,160	88.1	22,088	3,614	19.04
35	1,162	32.5	0		-
	1,164	40.0	0		-
	1,176	55.0	0		-
	1,156	71.0	1,068	667	0.92
	1,159	79.0	4,531	1,365	3.91
	1,174	83.0	1,677	300	1.43
	1,157	94.5	431	161	0.37

# So what don't we want?

- Excessively cold homes - kill and injure many
- High humidity levels - doesn't kill, but still comes at a cost

# So what do we want?

- Warm, efficient homes
- Easy and inexpensive to heat
- Well ventilated, able to maintain average RH to between 40-60%

# How to achieve this

- Building Regulations changed over time
- Until recently, not kept pace with best practice in Europe
- MVHR norm in many countries (*2016 in UK for new builds*)

# How to achieve this

- Replacement of windows and doors controlled by Building Regulations
- Existing dwellings - no worse than before
- Improve where considered necessary to prevent Damp and Mould hazard

# Best practice

- Trickle vents
- Extract systems from wet areas
- Humidity activated controls

# Guidance

- HHSRS Operating Guidance - Annex D
- Approved Document F (2010 edition - [http://www.planningportal.gov.uk/uploads/br/BR\\_PDF\\_ADF\\_2010.pdf](http://www.planningportal.gov.uk/uploads/br/BR_PDF_ADF_2010.pdf))
- Domestic Ventilation Compliance Guide ([http://www.planningportal.gov.uk/uploads/br/domestic\\_ventilation\\_compliance\\_guide\\_2010.pdf](http://www.planningportal.gov.uk/uploads/br/domestic_ventilation_compliance_guide_2010.pdf))

A blue-tinted photograph of a street lined with multi-story buildings. Several cars are parked along the left side of the road, and a white van is driving away in the distance. The word "Questions?" is overlaid in the center in a red, sans-serif font.

Questions?