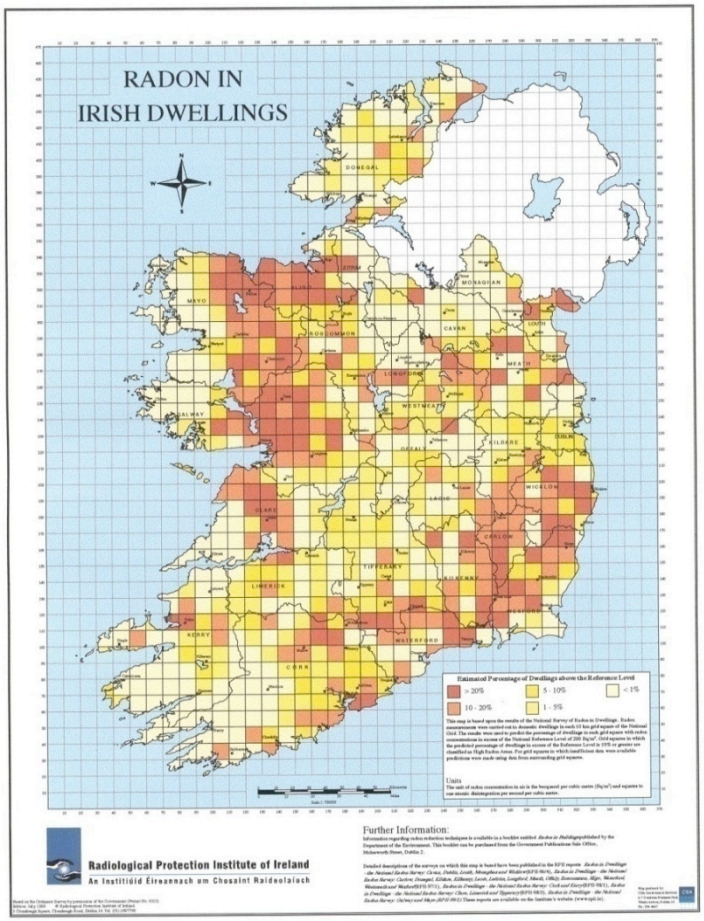
Economic evaluation of potential interventions to reduce radon exposure in Ireland

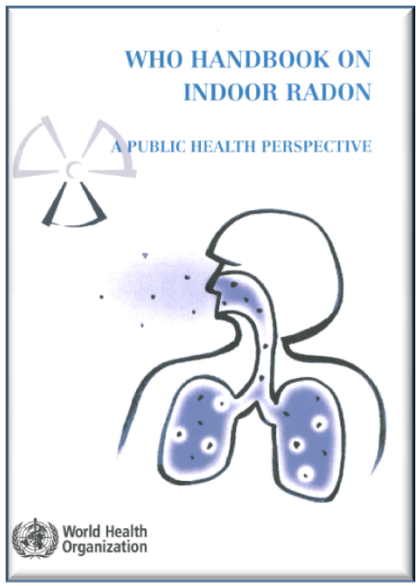
Radon in Ireland

- National Radon Survey:1992 – 1999 (based on 11,000 houses)
- National Reference Level: 200 Bq/m^3
- 7% of housing stock > Reference Level
- Average indoor concentration: 89 Bq/ m^3
- Large proportion of the west and south east of the country classified as high radon areas



WHO cost effectiveness model

- Health economics evaluation used to support development of National Radon Control Strategy.
- Methodology used: Cost effectiveness analysis (CEA) based on WHO model.
- CEA is used to compare cost per unit benefit for different radon interventions so as to achieve best public health outcome from finite resources.



Types of economic evaluation

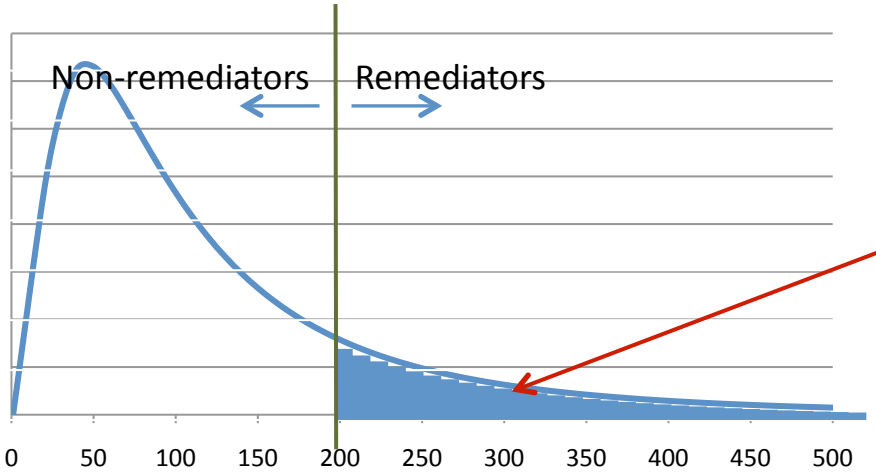
- **Cost benefit analysis** - both costs and consequences are presented in monetary terms. The method provides an overall view as to whether an intervention is economically desirable. Rarely used because of the difficulty in expressing benefits directly in monetary terms.
- **Cost effectiveness analysis** - outcomes are reported in a single unit (such as life years gained or QALYs) allowing cost effectiveness ratios to be calculated for alternative interventions. Does not provide an overall view on economic desirability but supports decision making between competing options. Widely used in healthcare resource allocation.

Accounting rules

(allows inter-comparison of results)

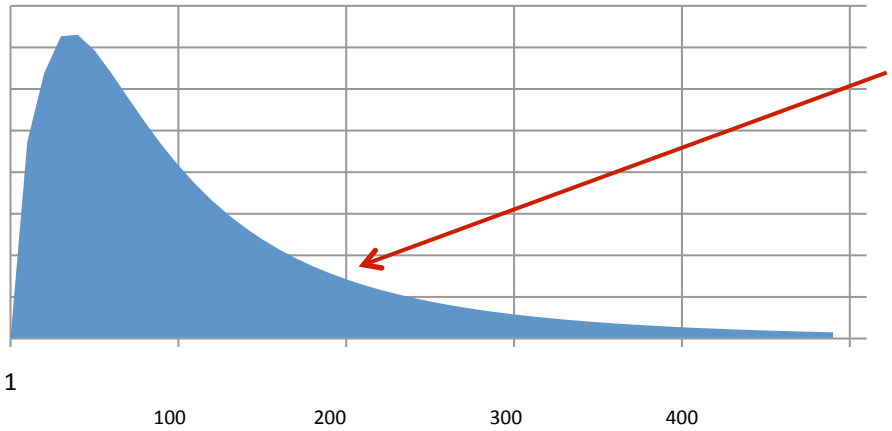
- Costs normalised to a remediated house
- Outcome expressed as euro per quality adjusted life year (QALY) saved (cost utility analysis).
- Benefits calculated on the basis of European pooled epidemiology study
- Societal costs – don't differentiate between costs borne by state and by individuals
- Future costs and benefits are discounted
- Costs summed over 85 years
- Cost effectiveness ratios calculated with and without health service costs
- Transfer costs not included

Remediation



Remediation reduces radon concentration in houses above the reference level. It has no impact on concentrations below the reference level. Most cancers result from exposure at these levels.

Prevention



Prevention reduces average radon concentration across all houses.

Costs for remediation

Category	Components	Calculation
Education + awareness raising	•Publicity and invitation costs normalised to unit house remediated	$Cost_{Edu} = \frac{Cost_{Invit}}{f_{al} \times R_{Mit} \times R_{Acc}}$
Testing	•Measurement cost normalised to unit house remediated	$Cost_{Survey} = \frac{Cost_{meas}}{f_{al} \times R_{mit}}$
Remediation	•Direct cost of remedial work •Post remediation testing •Electricity consumer (over 85 years (discounted) •Maintenance + replacements costs over 85 years (discounted)	$Cost_{rem} = Cost_{inst} + \sum_{1}^{85} \left(Cost_{elec} \times Watts_{fan} \times 8760 \times df_y\right) + \sum_{1}^{85} \left(\frac{Cost_{Fan} \times df_y}{Life_{fan}}\right)$
Health services	•Treatment cost saved •Health care consumption per life year gained	$Cost_{HS} = \sum_{1}^{85} Cost_y \times LY_{gain} \times C_{avert} \times df_y - Cost_T \times C_{avert} \times df_y$

Costs for prevention

Category	Components	Calculation
Prevention	•Direct cost of preventive work in new build	
Health services	•Treatment cost saved •Health care consumption per life year gained	$Cost_{HS} = \sum_{1}^{85} Cost_y \times LY_{gain} \times C_{avert} \times df_y - Cost_T \times C_{avert} \times df_y$

What is cost effective

NICE - Interventions with a cost <€25,000 per QALY gained are likely to be viewed favourably, whereas those with a cost per QALY gained of >€35,000 are likely to be viewed unfavourably

World Bank – Interventions which cost Similar to Gross National Income (GNI)per person are considered cost effective. In 2010 GNI for Ireland was ≈ €33,000

US - Interventions which cost ≈ $50,000 are considered cost effective

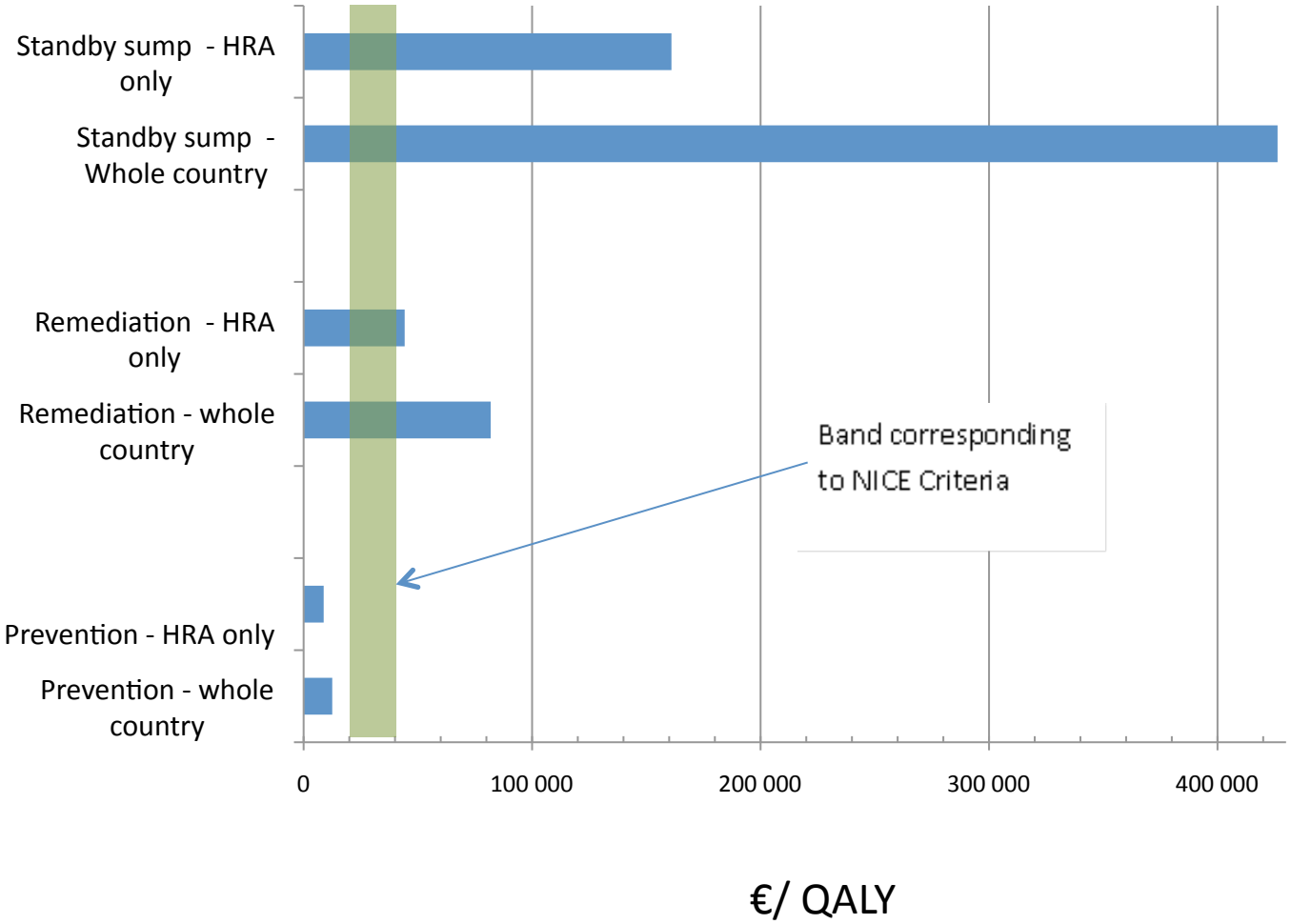
Different strategies applied to whole country (€/QALY)

	Awareness raising	Survey	Intervention	Health Service	Total
Prevention	Nil	Nil	9,000	3,000	12,000
Remediation	33,000	17,000	29,000	3,000	82,000
Remediation (with standby sump)	33,000	17,000	370,000	3,000	420,000

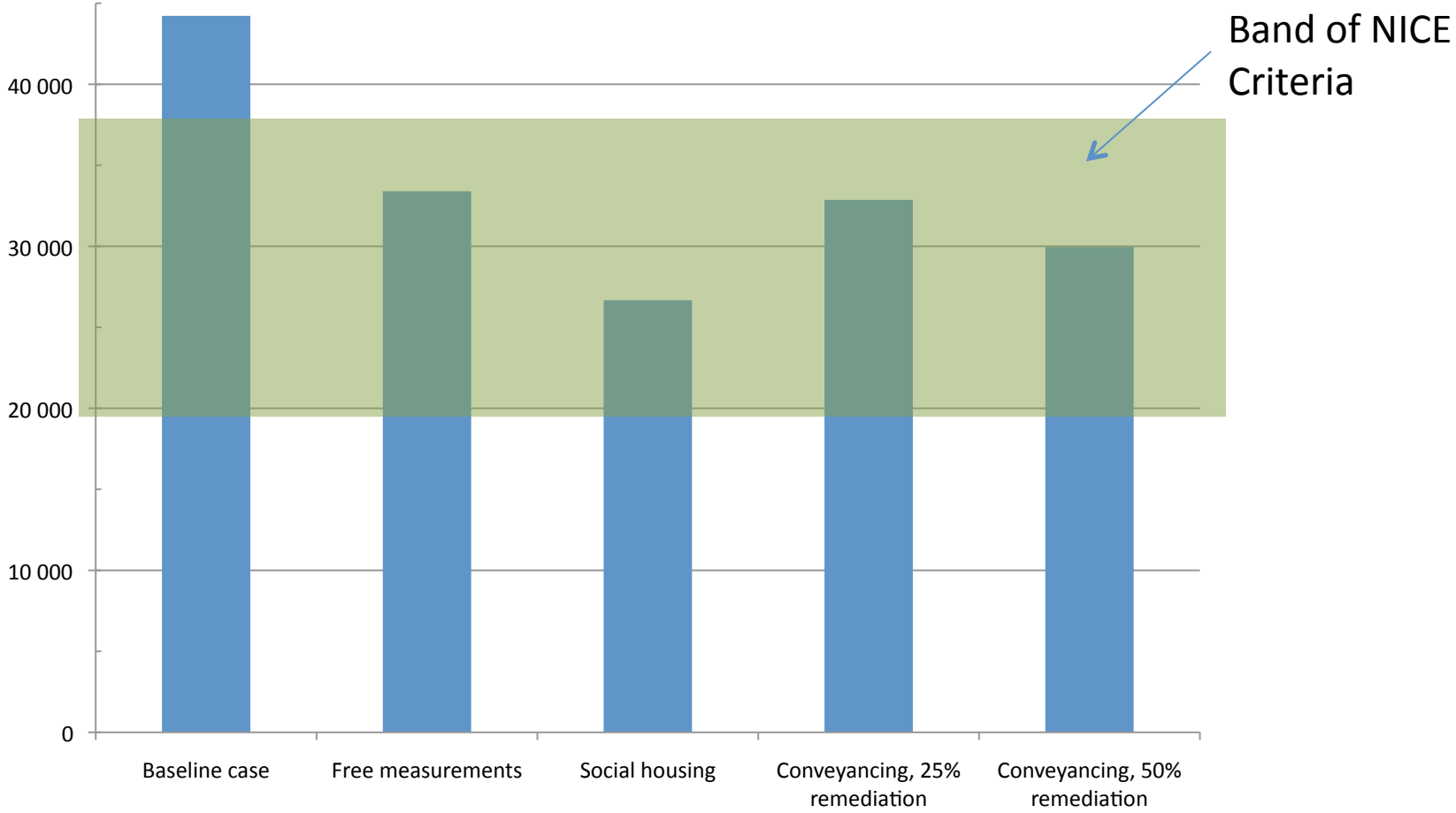
Different strategies applied to high radon areas (€/QALY)

	Awareness raising	Survey	Intervention	Health Service	Total
Prevention	Nil	Nil	5,000	3,000	8,000
Remediation	11,000	6,000	24,000	3,000	44,000
Remediation (with standby sump)	11,000	6,000	140,000	3,000	160,000

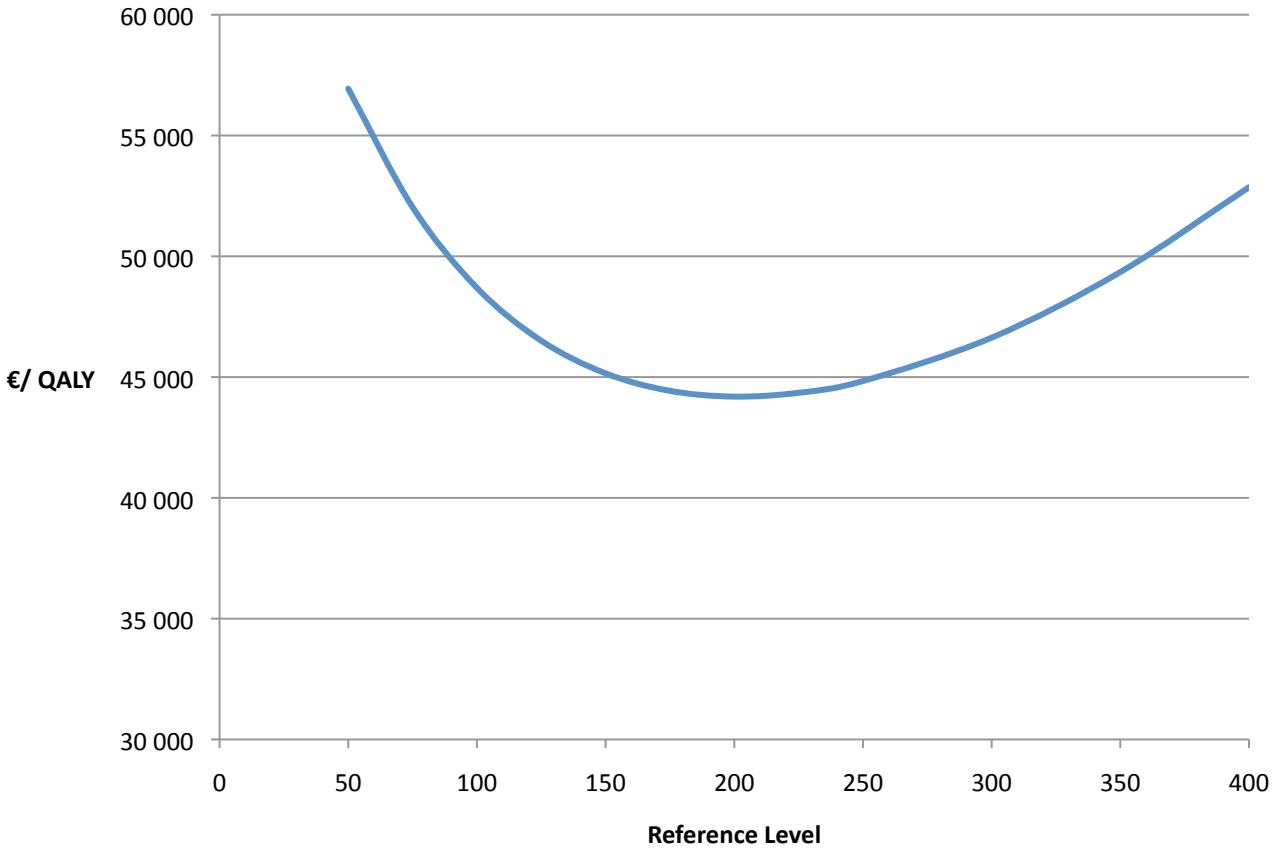
Cost effectiveness of radon interventions compared with the NICE criteria



Impact on cost effectiveness of alternative policy options to promote remediation



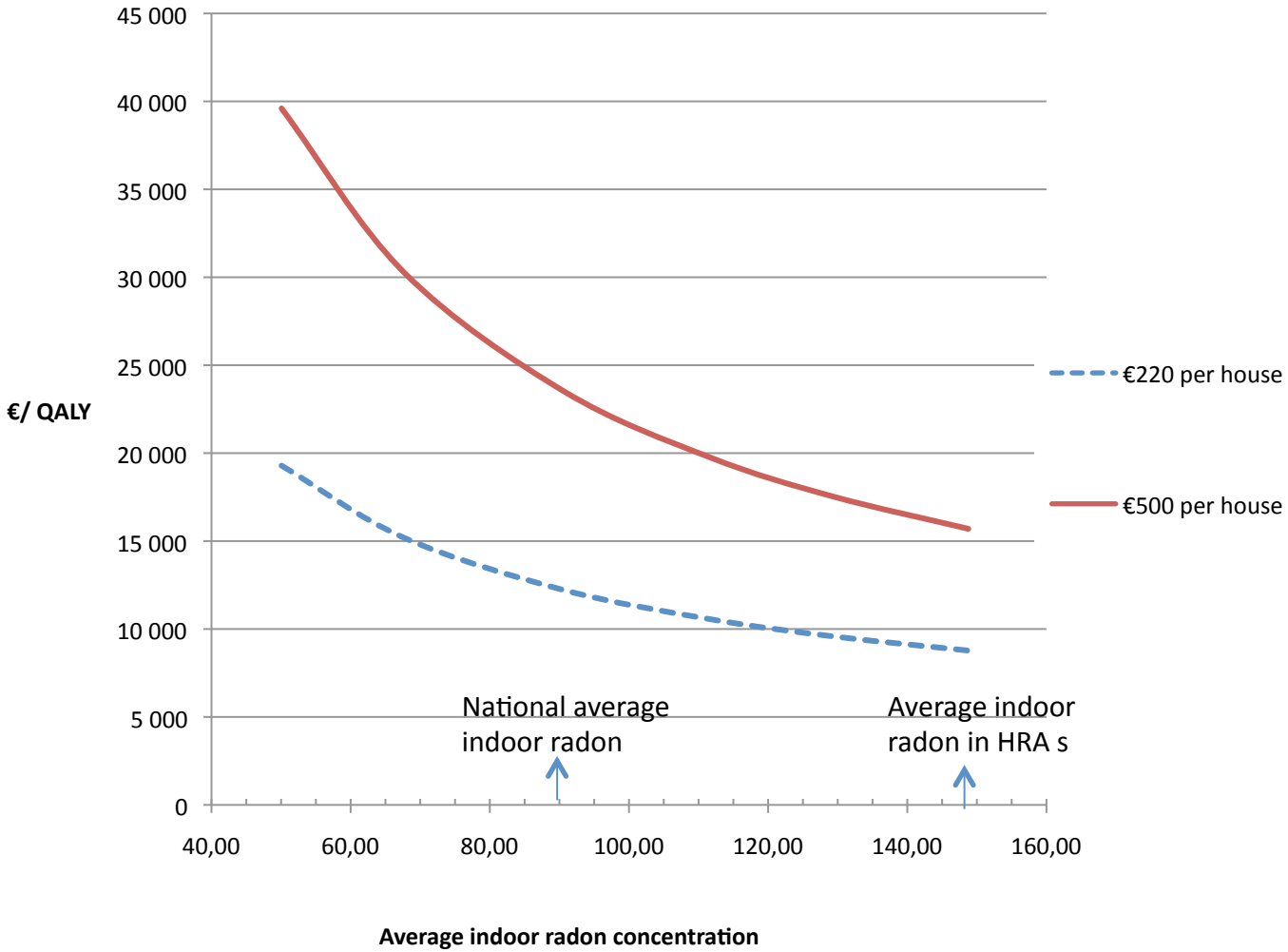
€/QALY gained for remediation as a function of reference level



QALY per intervention low

Education and testing costs dominate

Cost effectiveness of prevention versus average indoor radon concentration



Key messages

- Incorporation of prevention into new buildings at the time of construction is the most cost effective intervention.
- It is expensive to find homes and to persuade householders to act.
  - Education & testing dominate the overall cost of remediation (particularly in low risk areas).
  - Direct remediation costs relative small proportion of overall intervention cost.
- Cost effectiveness of remediation programmes is significantly better in high radon areas.
- Cost effectiveness of remediation improved by measures which increase test uptake and remediation rates. (Success of awareness campaigns should be judged on the number of houses remediated.)
- The cost effectiveness of putting standby sump in new houses is poor.

Experience for strategy process

- CEA is a useful support to policy makers evaluating alternative policy options.
- Like all models it is a simplification of reality and is dependent on the assumptions and inputs.
- CEA is primarily concerned with efficiency but equity and fairness may also be important to policy makers.
- CEA cannot be the sole basis for decisions.
- CEA generally does not produce surprises but does bring clarity and transparency to decision making.