

How Safe is Safe?

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Fire Engineering Design and Risk Assessment

- Introduction to new British Standard – DD9999
 - Risk based design approach

- Should fire resistance periods be increased for ultra-high buildings?

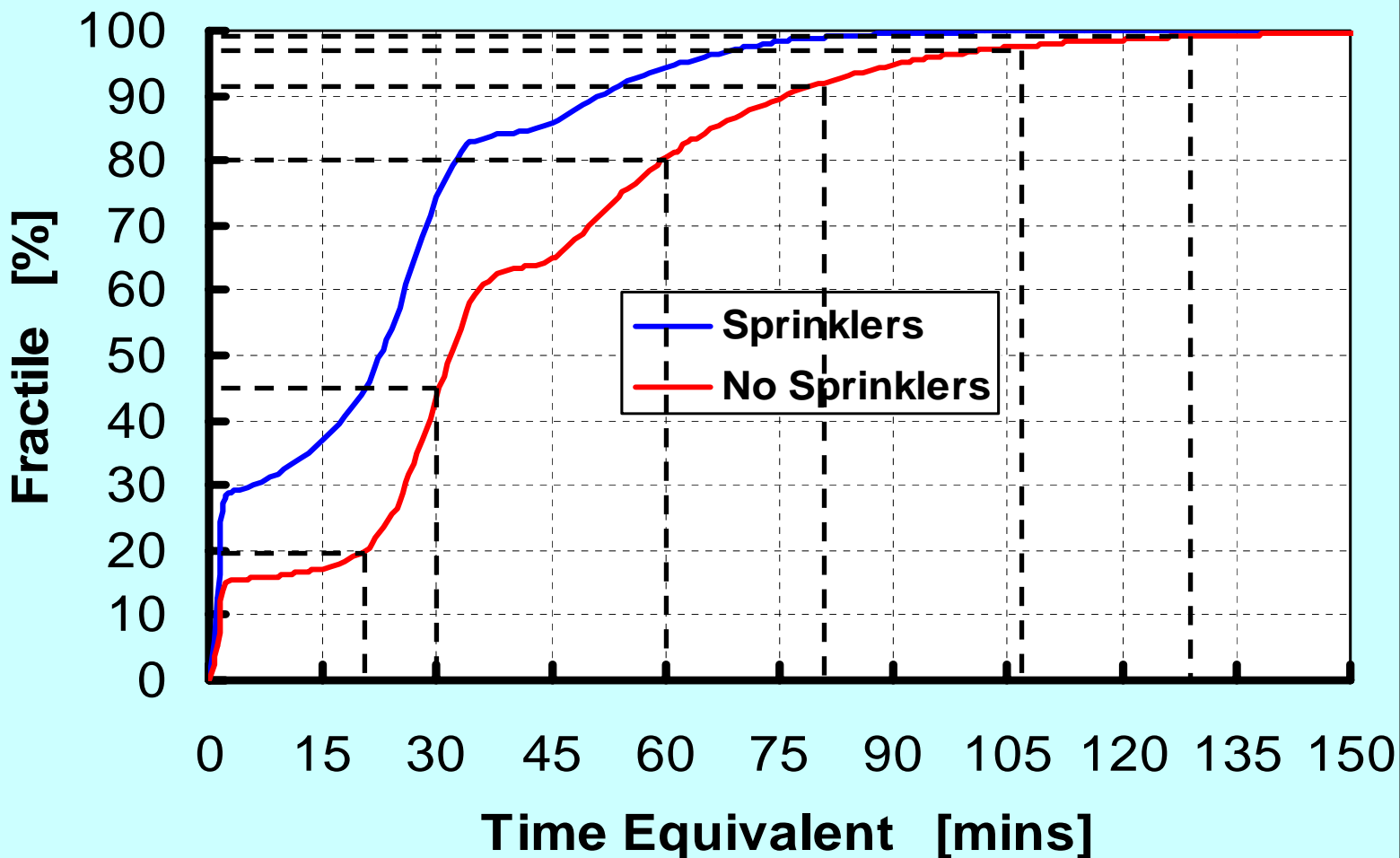
An Introduction to BS9999

- Risk = f(Frequency, Likelihood, Consequence)
- Risk = Frequency x Likelihood x Consequence
 - Frequency is proportional to height of building
 - Likelihood determined Monte Carlo analysis of possible fire scenarios
 - Consequence is proportional to building height
- Risk $\propto h \times (1 - \text{Fractile}/100) \times h$
- Risk $\propto (1 - \text{Fractile}/100) \times h^2$

- Risk $\alpha (1 - \text{Fractile}/100) \times h^2$
 - Use 80% fractile and 18m
- Risk $\alpha (1 - 0.8) \times 18^2$
- Risk $\alpha 64.8$
- Derive fractiles to ensure constant risk
- Create cumulative distribution curves using Monte Carlo
- Use fractiles to determine fire resistance periods

Height (m)	Fractile %	Consequence rating
0-5	20	1
5-11	46.4	2
11-18	80	3
18-30	92.8	4
30-60	98.2	5
>60	99.6	6
****	100	7

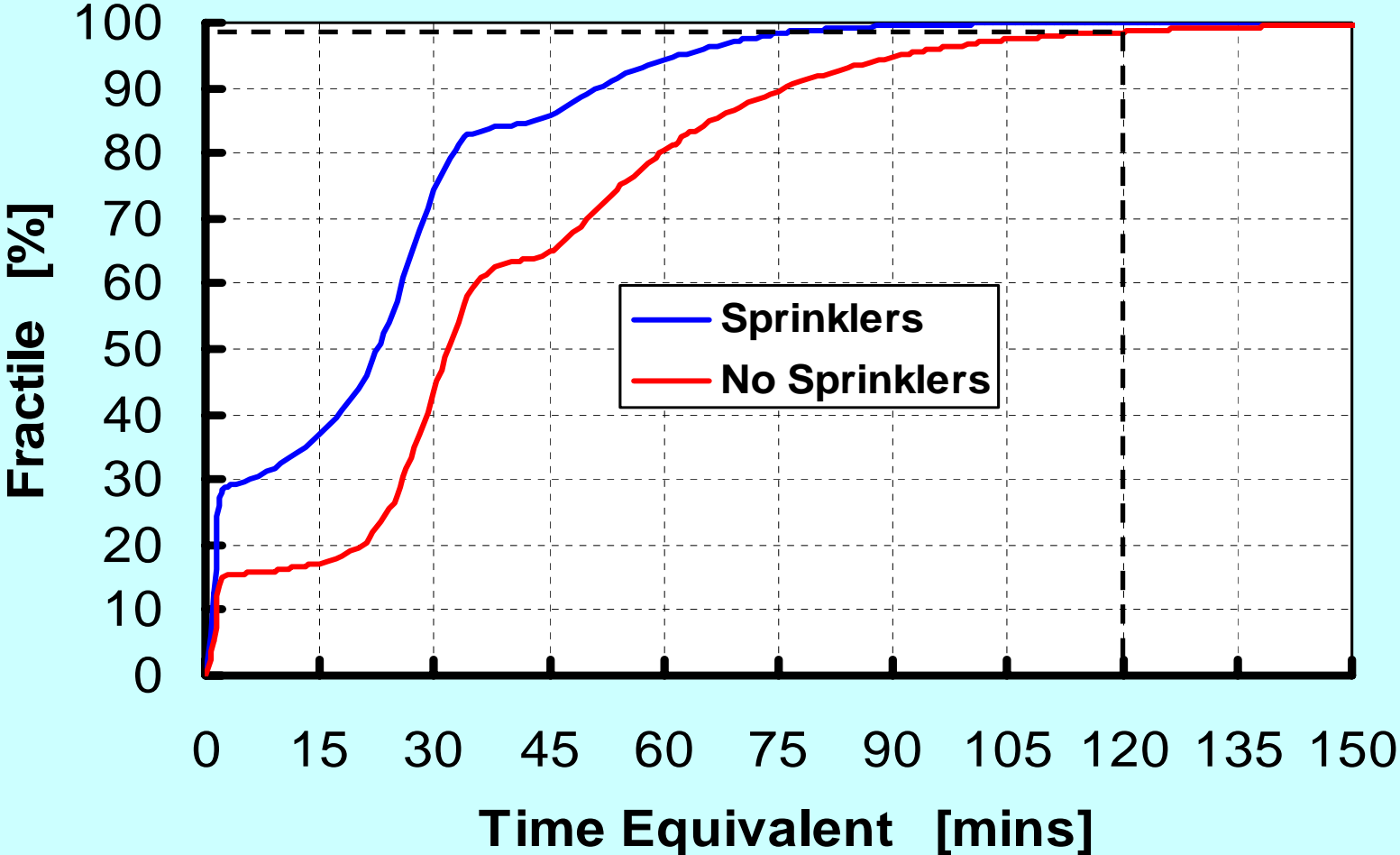
Cumulative Distribution - Offices

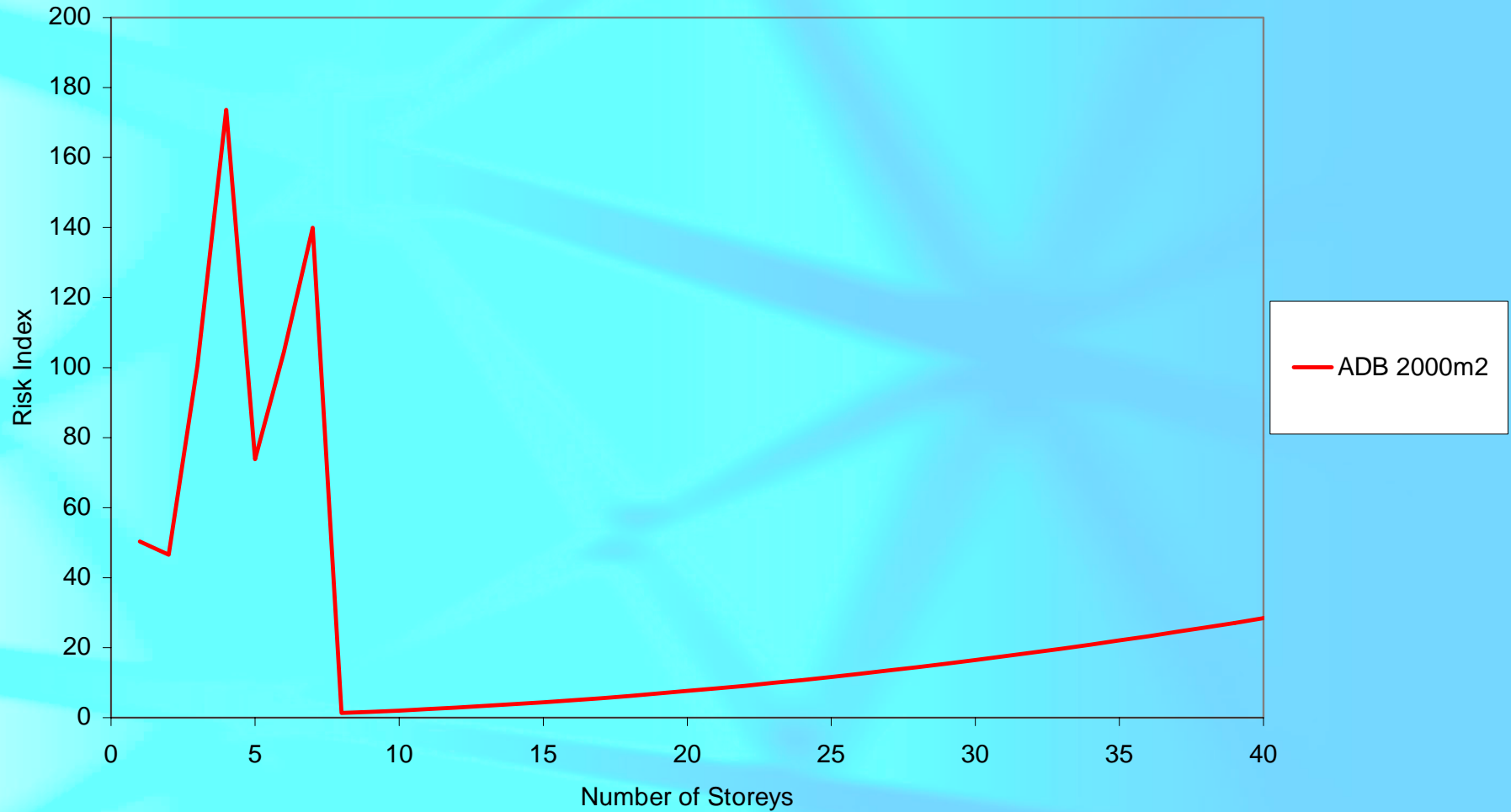


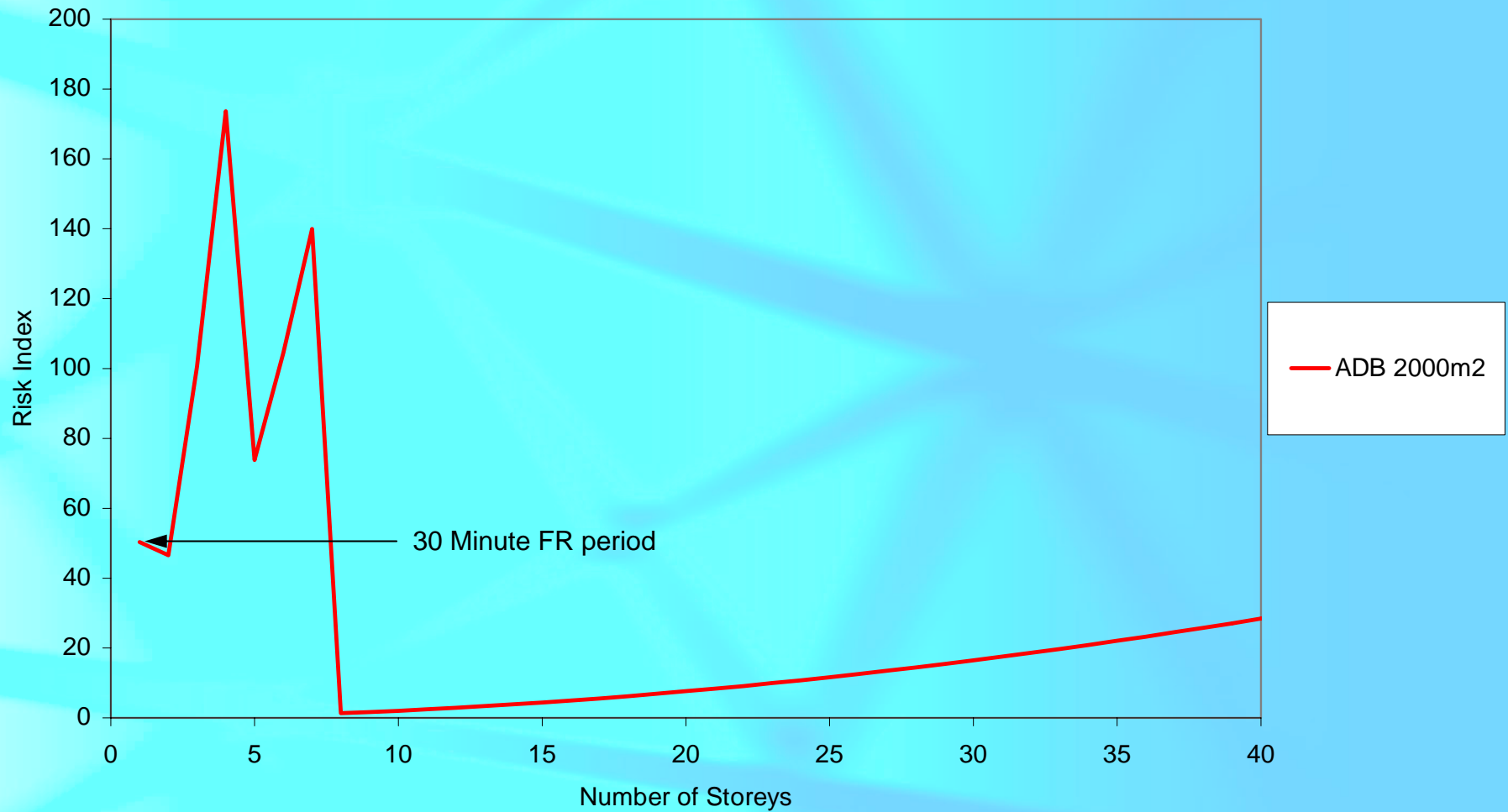
Should fire resistance periods be increased for
ultra-high buildings?

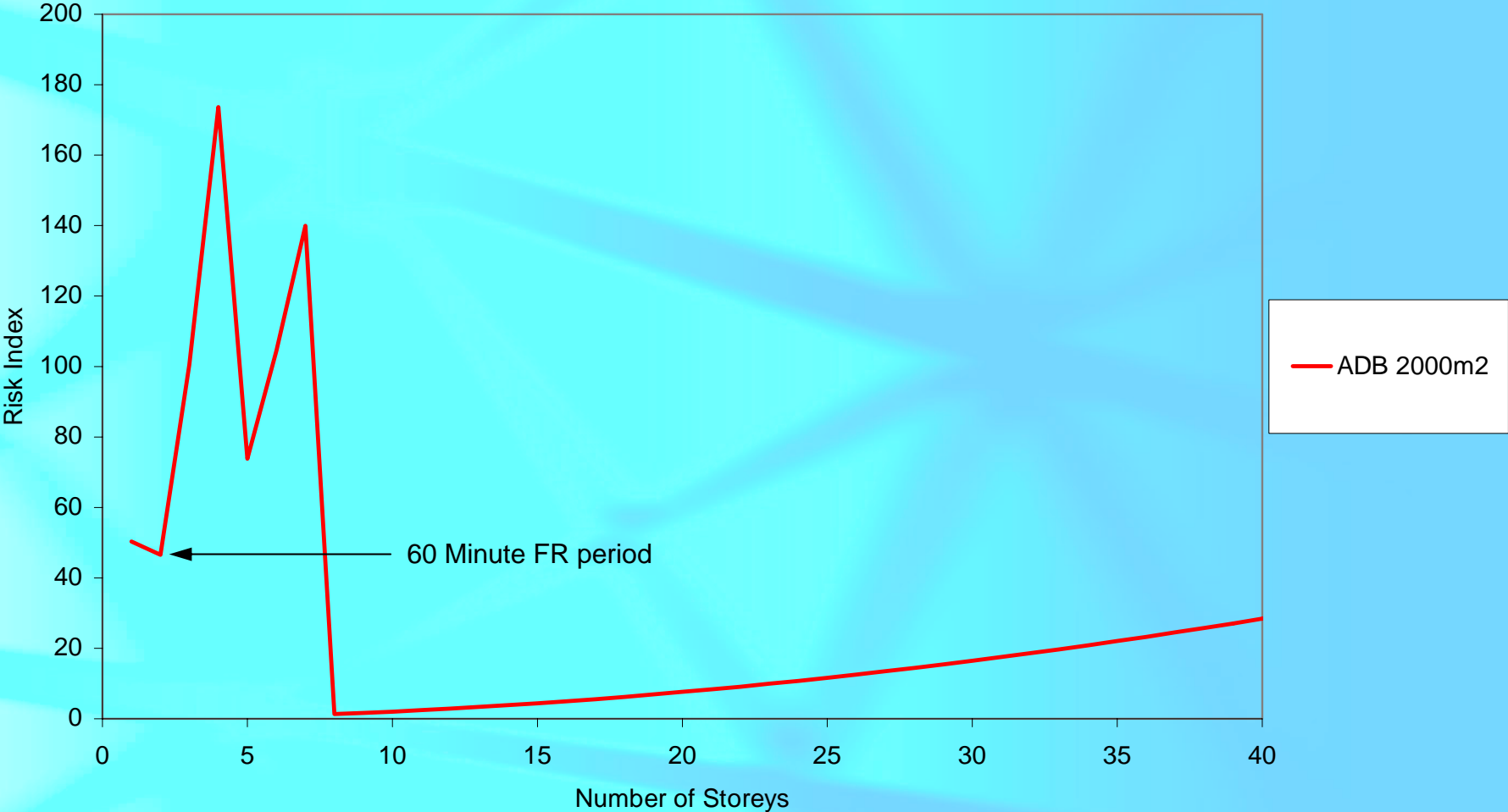
- Use the DD9999 approach, but work backwards
 - Start with the cumulative distribution curve
 - Read off the likelihood of failure for different fire resistance standards
 - Calculate the risk

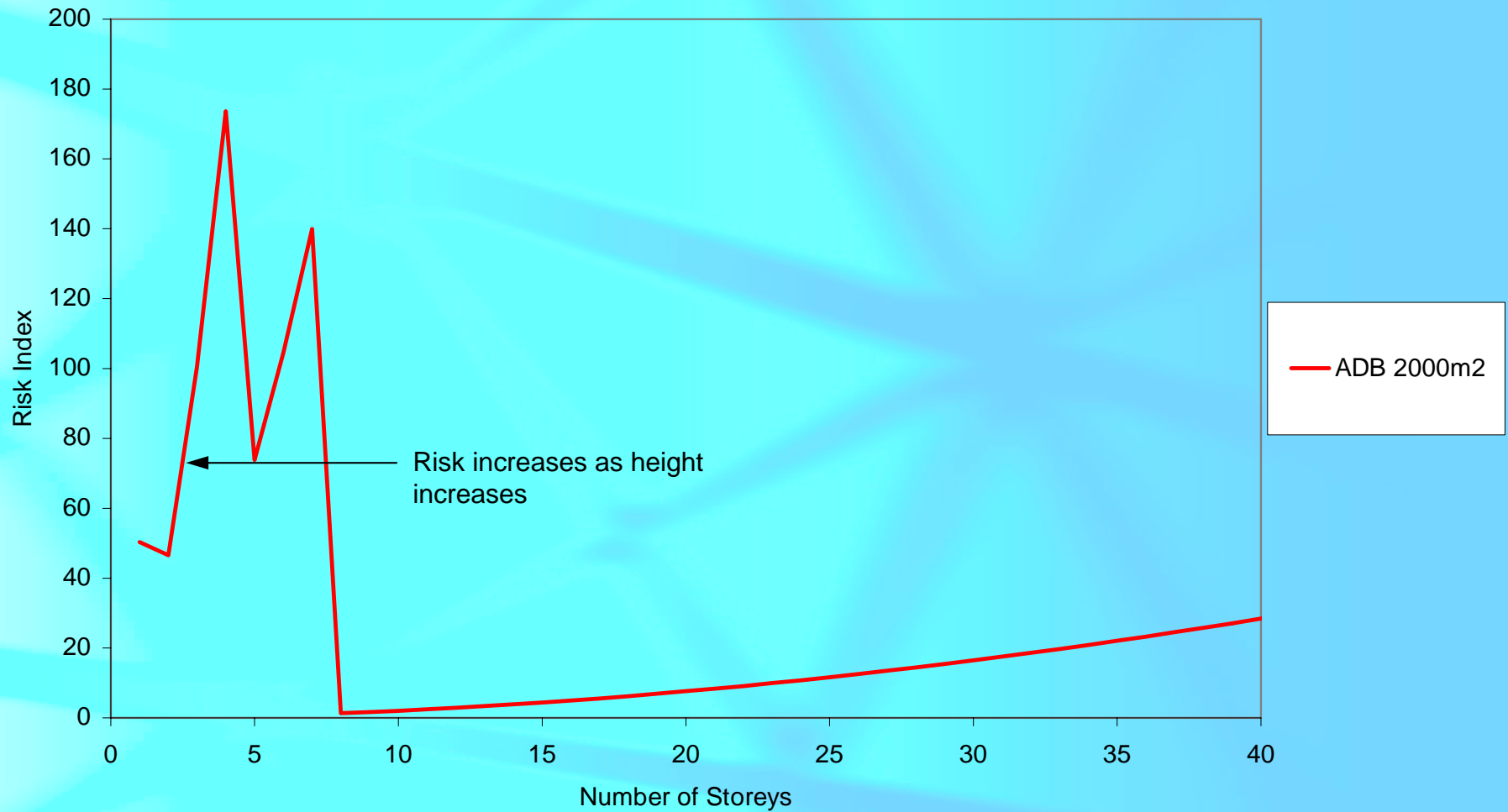
Cumulative Distribution - Offices

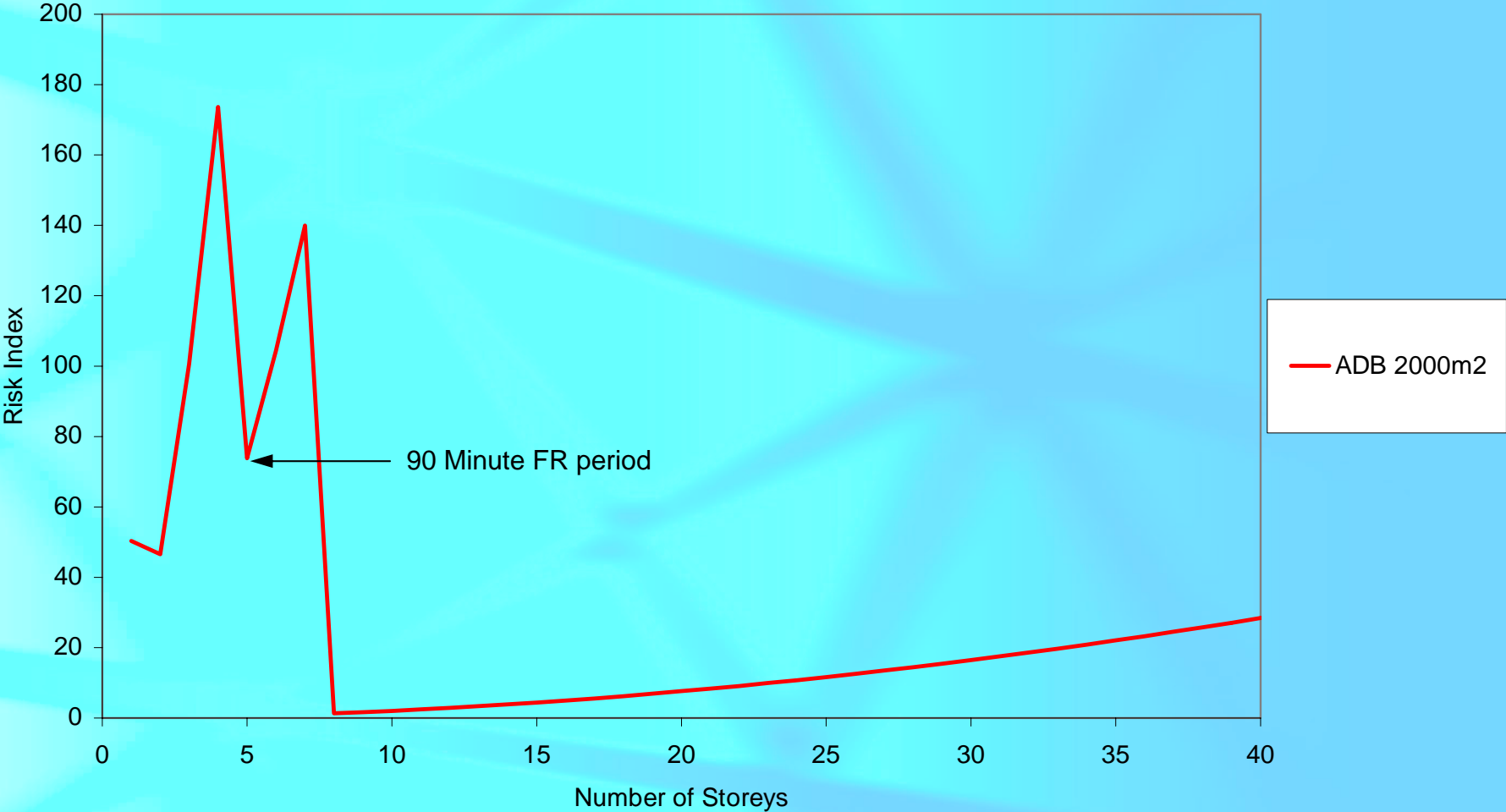


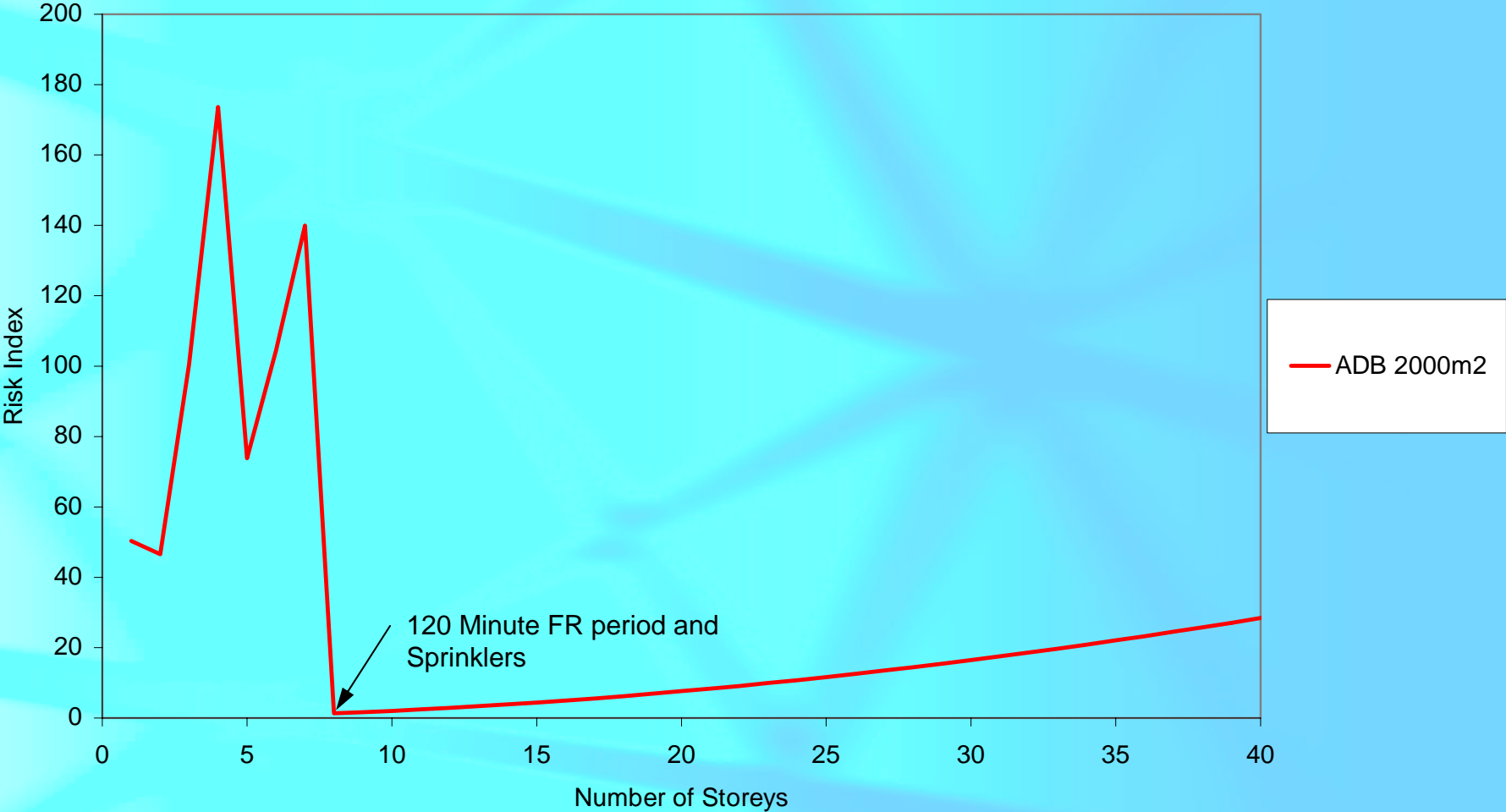


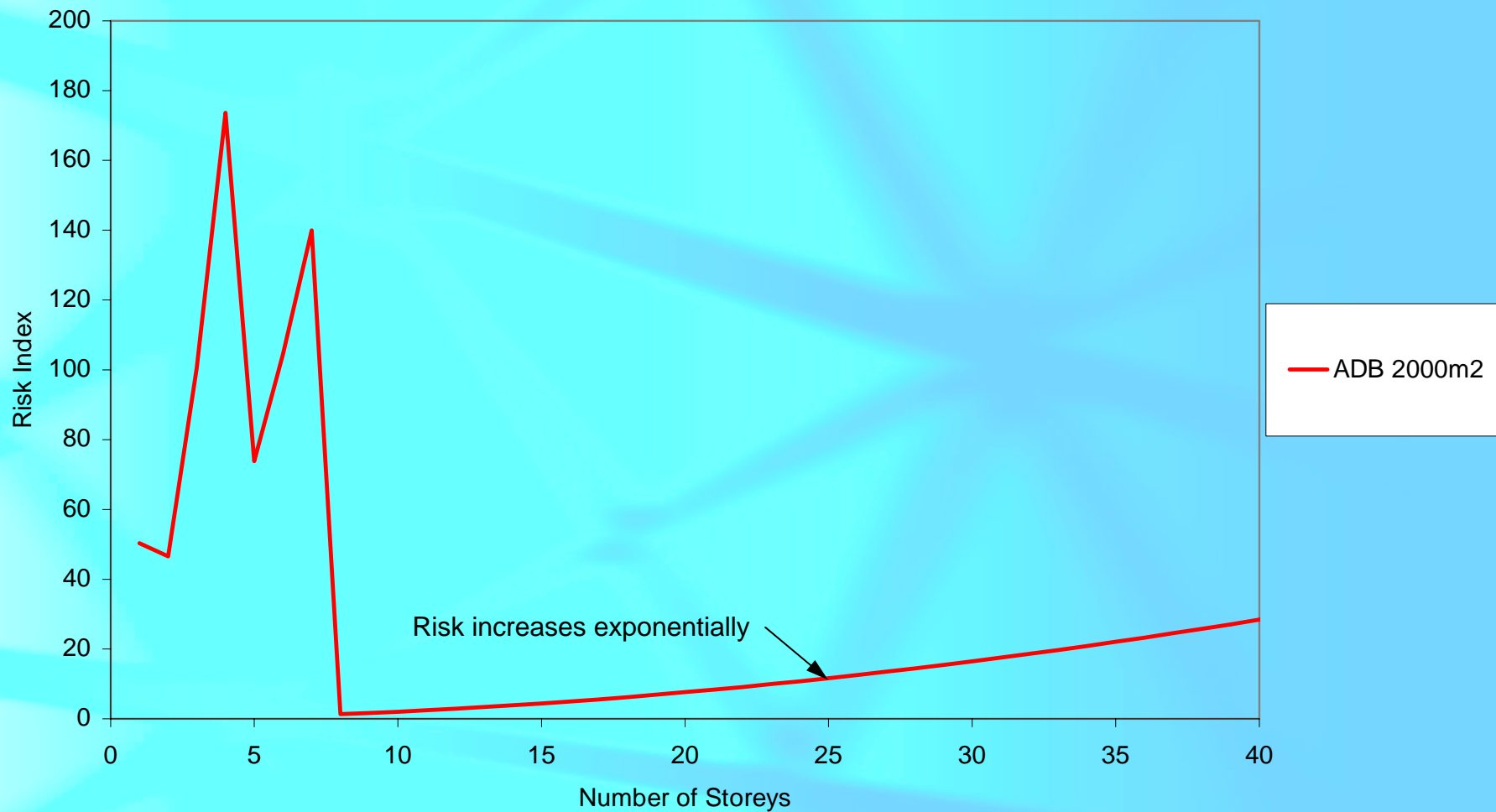


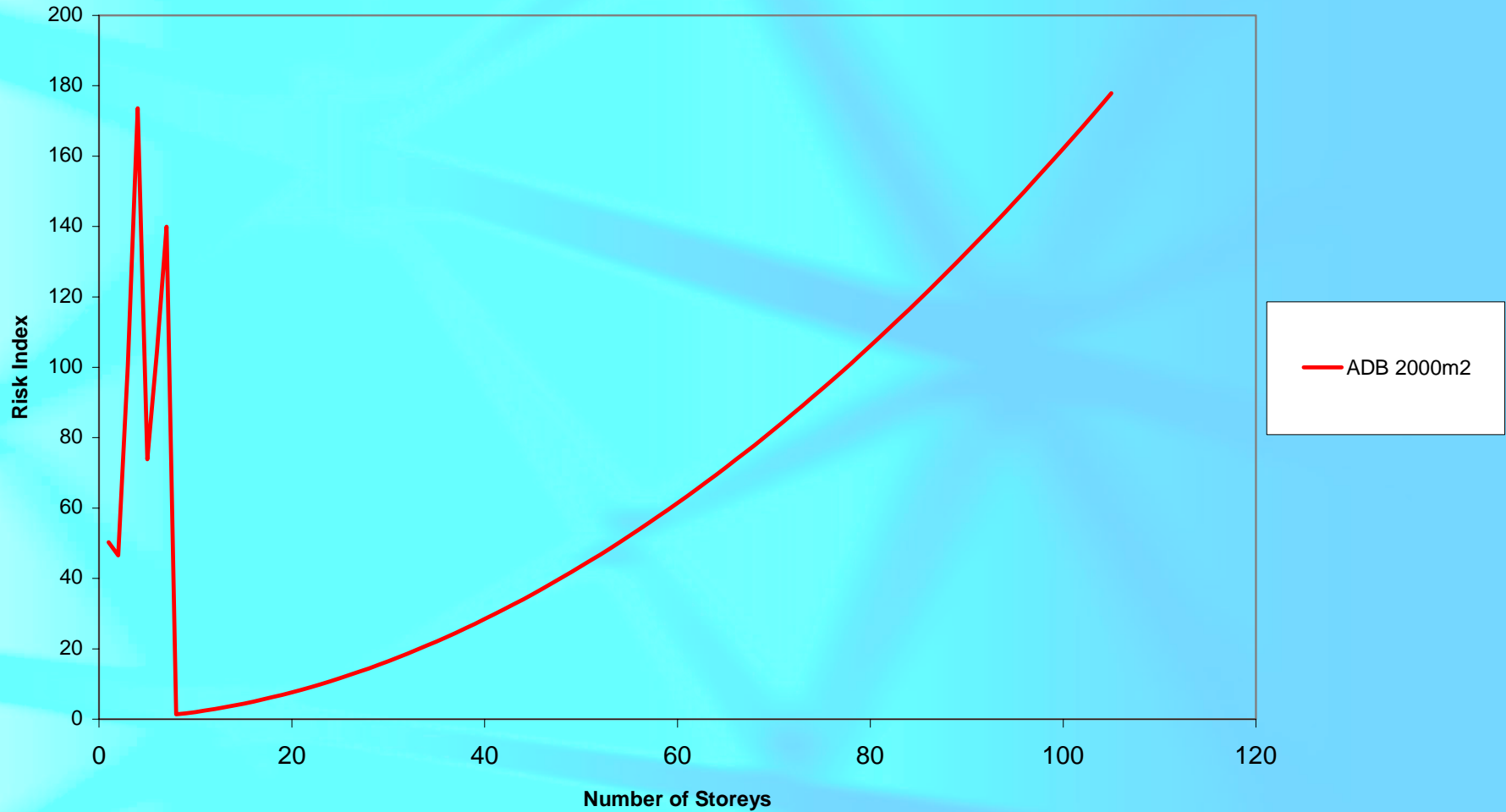


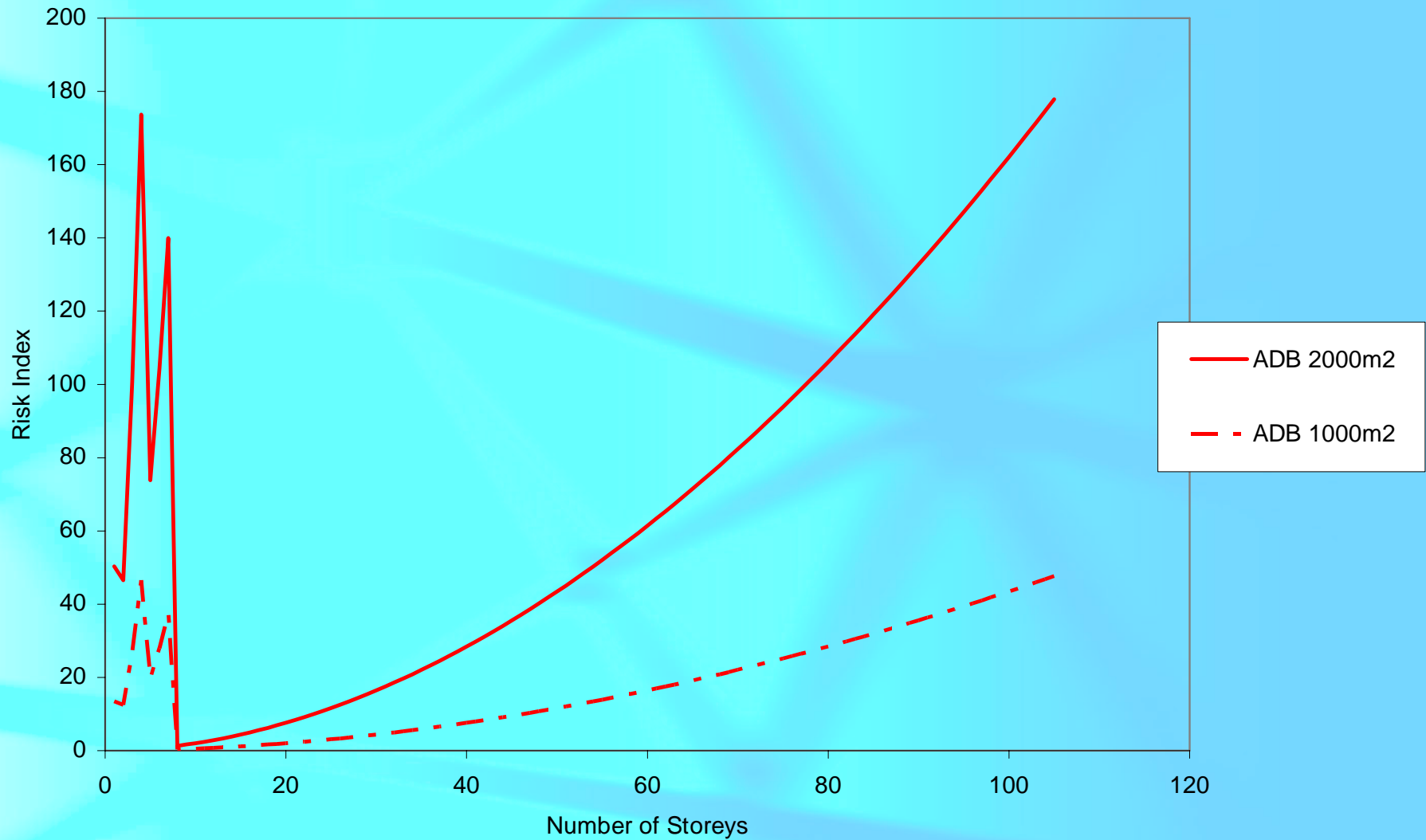


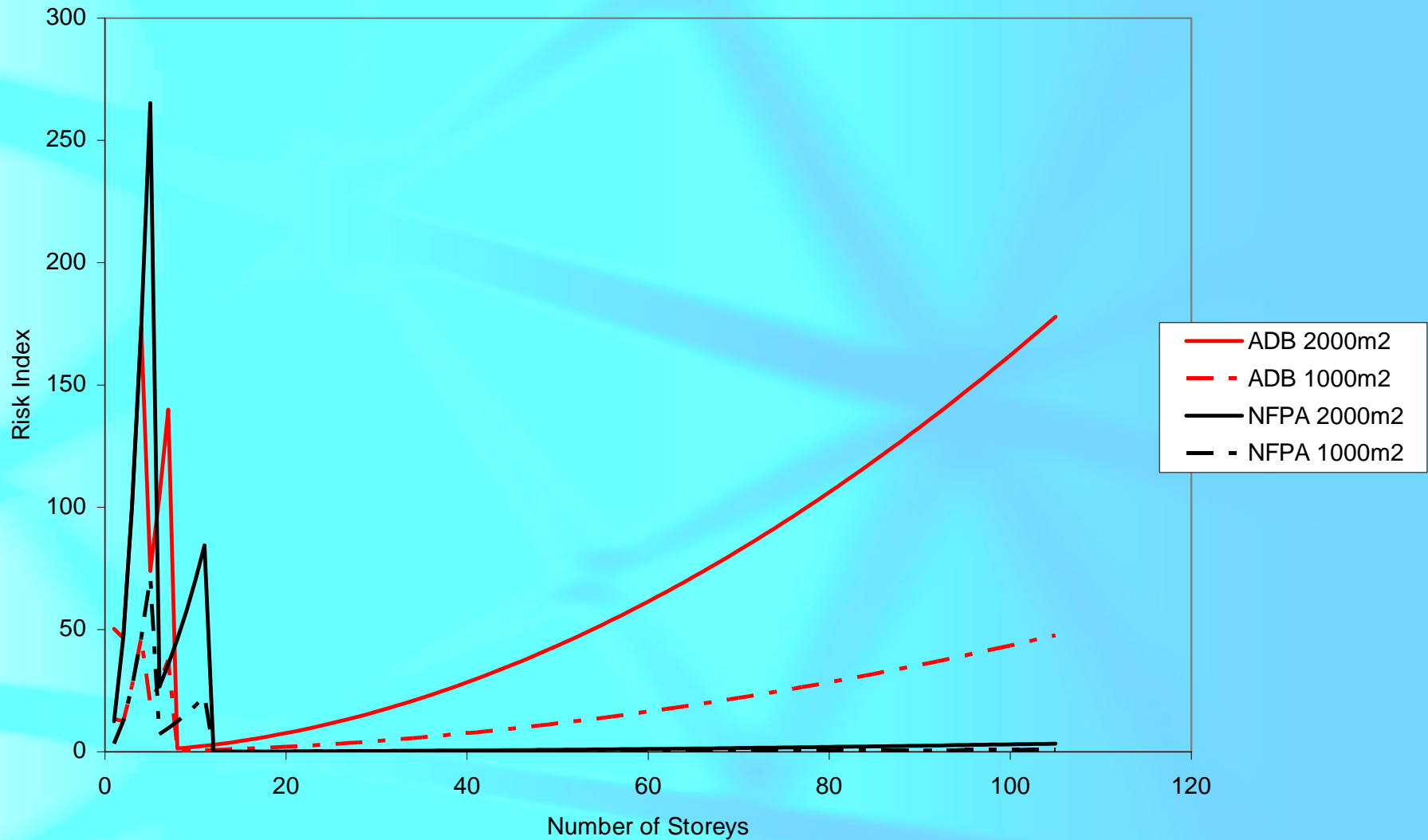


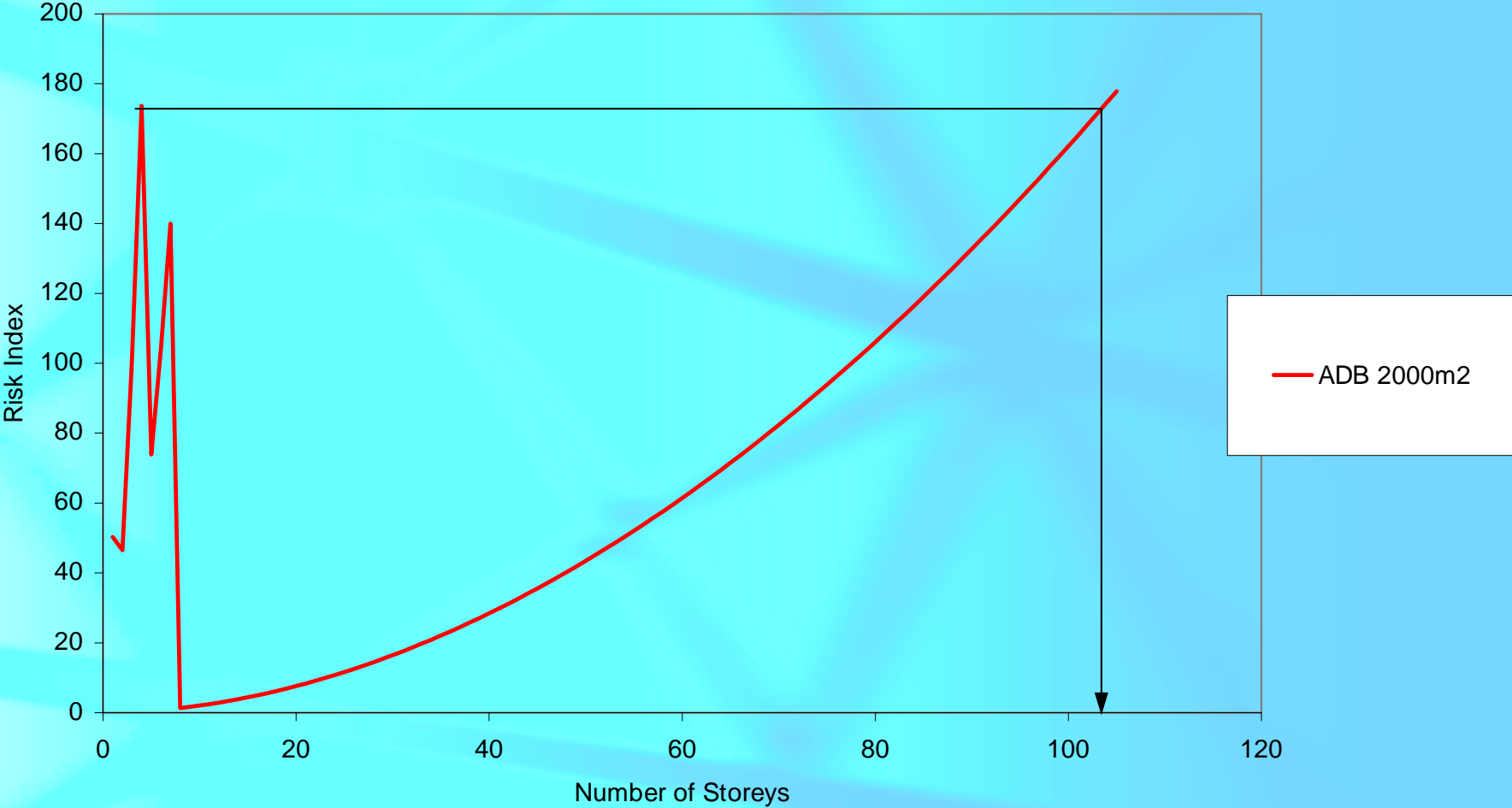




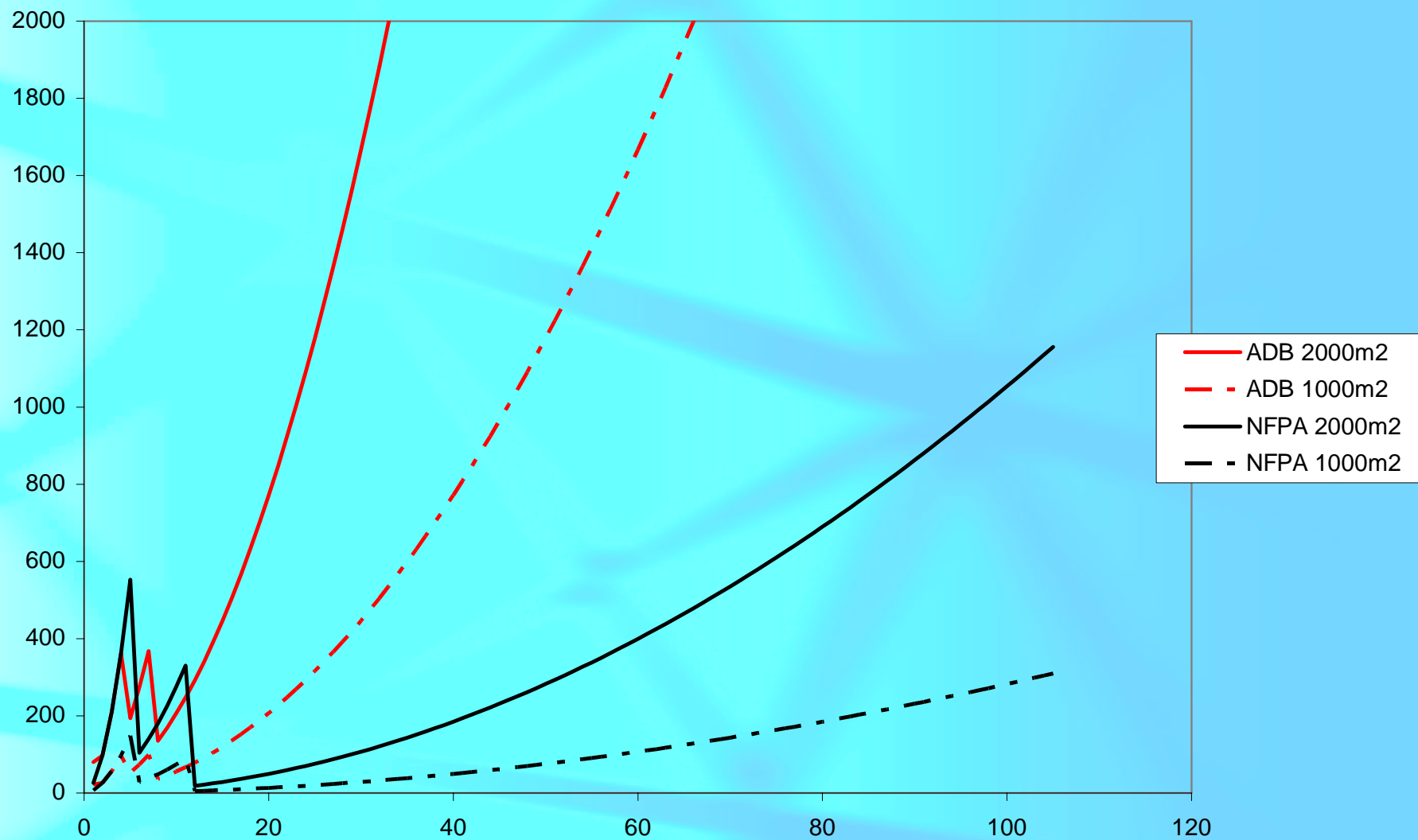


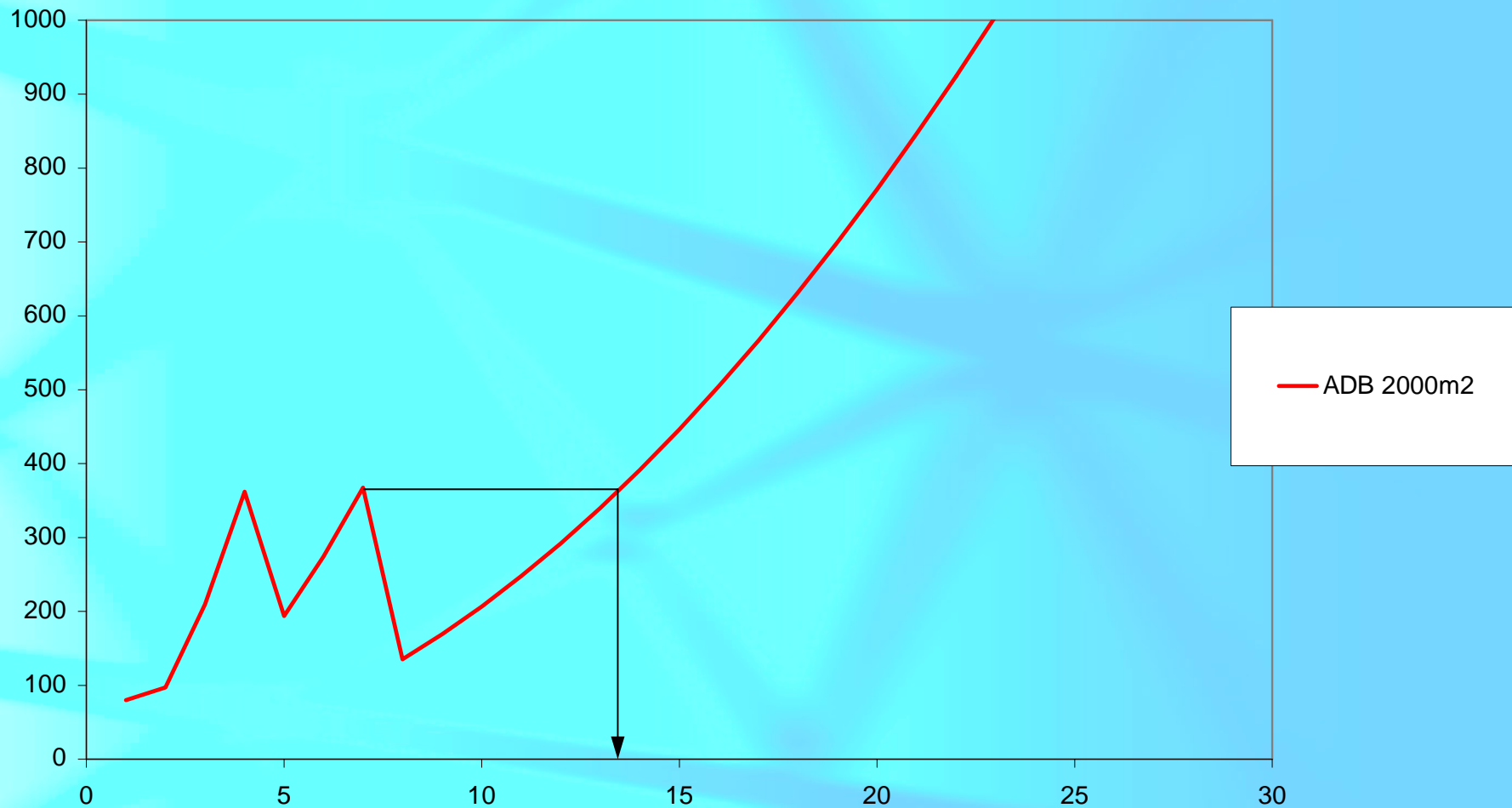






- Sprinklers - 80% to 95%
- Passive fireproofing - 75% of nominal rating
75% of the time





- Societies acceptance of risk decreases with increasing consequence

