

- (Modarres 2.5) The following information about risk of school bus accidents are known. There are 448000 school buses in the US, annually 130 accident deaths occur. Approximately 3 % of all fatalities are fire fatalities of which 8 % are occupants of the bus, the rest are pedestrians and occupants of other cars involved in the accidents with the buses. Each bus travels an average of 9500 miles/year. Determine:
 - Frequency of fire-related fatalities for both occupants and non-occupants of the school buses.
 - Fire-related fatality for occupants and non-occupants per unit of distance traveled.
 - Mean length of operation time per bus so that the total fire risk reaches 10^{-6} per person.
- (Modified Modarres 2.1) The following table shows the data calculated for a fictitious Nuclear Power Plant.

| Scenario | Annual frequency of scenario | Expected number of fatalities |
|-----------------------------|------------------------------|-------------------------------|
| Fire in main control room | 2.00×10^{-8} | 800 |
| Fire in reactor hall | 1.30×10^{-7} | 80 |
| Core melt of first reactor | 2.50×10^{-6} | 2500 |
| Core melt of second reactor | 1.35×10^{-5} | 3000 |
| Explosion of the plant | 1.70×10^{-5} | 9000 |

- Based on the data in this table, plot the risk profile in terms (annual frequency of exceeding the given number of fatalities versus number of fatalities). That is the so-called Farmer's curve.
 - What is the frequency of exceeding 100 fatalities?
- Consider two different power plant designs A and B whose sulfide dioxide filters are subject to failure with the following probabilities and consequences.

| | Design A | Design B |
|----------------------------|-----------|-------------|
| Annual failure probability | 0.1 | 0.001 |
| Release of SO ₂ | $10g/m^3$ | $1000g/m^3$ |

- Assume 1000 plants of each type, draw the Farmer's curve.
- Which design will more likely release more than $1000g/m^3$ of sulfide dioxide?
- What about if more than $2000g/m^3$?
- What should the filter failure probability be for plant design B so that the probability of release more than $2000g/m^3$ is lower than 5 %.

4. (Modified Modarres 2.3) Which of the following two technologies is riskier? Draw the Farmer's curve and make a comparison.

