# What We'll Discuss

TOPIC OUTLINE

Assessment of Safety and Risk

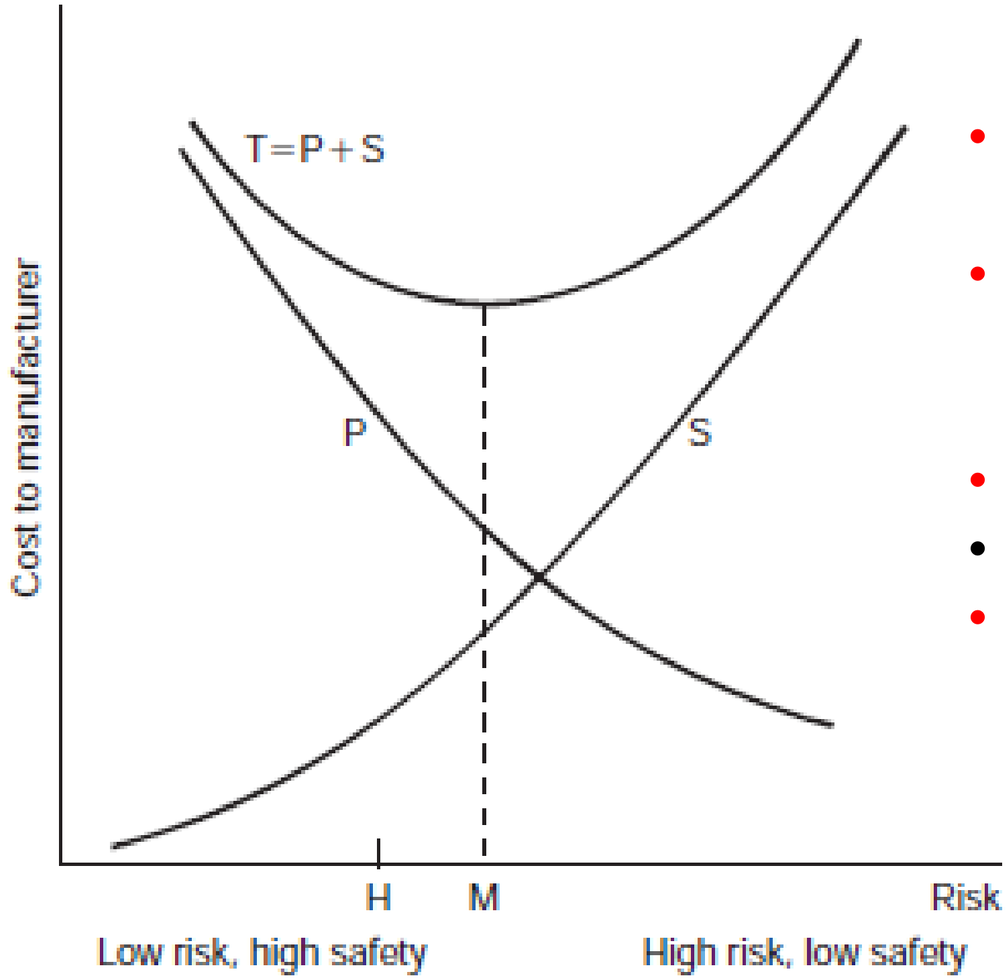
Uncertainties in Design

Risk Benefit Analysis

# Assessment of Safety and Risk

- Any improvement in safety as it relates to an engineered product is often accompanied by an increase in the cost of that product.
- Conversely, products that are not safe incur secondary costs to the manufacturer beyond the primary (production) costs that must also be taken into account.
- Costs associated are: warranty expenses, loss of customer goodwill and even loss of customers, litigation, and possible downtime in the manufacturing process.
- It should now be clear that ‘safety comes with a price’ only.

# Assessment of Safety and Risk




- P - primary cost of product, including cost of safety measures
- S- secondary costs, including warranties, loss of customer goodwill, litigation costs, costs of downtime, and other secondary costs.
- T – Total Cost (T=P+S)
- Minimum total cost occurs at M
- H- Highest acceptable risk may fall below risk at least cost (M),

# Assessment of Safety and Risk

- The aim of the risk assessment process is to remove a hazard or reduce the level of its risk by adding precautions or control measures, as necessary.
- By doing so, you have created a safer and healthier workplace.

# Uncertainties in Design

- Uncertainties regarding materials and skills required in the manufacturing
- Changing economic realities.
- Unfamiliar environmental conditions like very low temperature
- A decision on maximizing profit or maximizing the return on investment.
- Uncertainties about applications like dynamic loading instead of static loading, vibrations, wind speeds.
- The available standard data on items like steel, resistors, insulators, optical glass, etc are based on statistical averages only.

# Testing strategies for safety

Some commonly used testing methods:

- Using the past experience in checking the design and performance.
- Prototype testing: Here the one product tested may not be representative of the population of products.
- Tests simulated under approximately actual conditions to know the performance flaws on safety.
- Routine quality assurance tests on production runs.

# Testing strategies for safety

The above testing procedures are not always carried out properly. Hence we cannot trust the testing procedures uncritically.

In such cases, a simulation that traces hypothetical risky outcomes could be applied.

Scenario Analysis (Event -> Consequences)

Failure Modes & Effects Analysis (Failure modes of each component)

Fault Tree Analysis (System Failure -> Possible Causes at component level)

# Example of Testing for safety

## Failure modes and effect analysis (FMEA) :

- This approach systematically examines the failure modes of each component, without however, focusing on relationships among the elements of a complex system.

## Fault Tree Analysis (FTA) :

- A system failure is proposed and then events are traced back to possible causes at the component level. The reverse of the fault-tree analysis is ‘event – tree analysis’.

# THANK YOU