

Failure in Engineering Design

- Full of Examples of Design Flaws that escaped detection in the design phase only to reveal themselves once the device was in actual use.
- Mistakes were made by engineers who did the best they could, but had little poor experience or had major lapses in engineering judgment.
- Cause study and new/revised engineering standards and guidelines.

Fill in the missing number.

5	6	7	8	9
52	63	94		18

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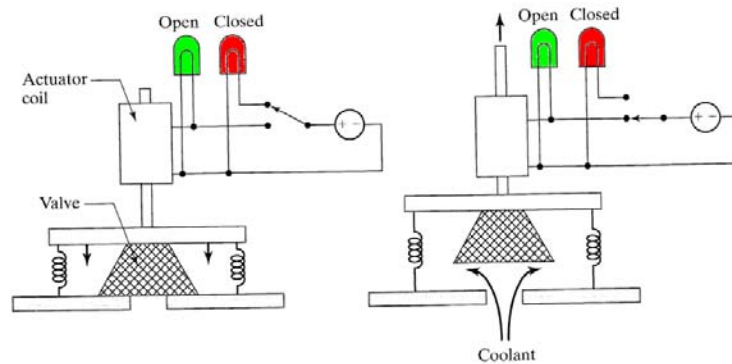
TMI Example

- Three Mile Island (TMI)
- Nuclear Power Plant in PA
- Near miss meltdown accident
 - Reactor coolant leakage
 - Plant shutdown (and later completely!!!)
 - Loss of Power Generation
 - Pressure Build-up inside Reactor Vessel
 - Supposed to open a relief valve to reduce the pressure
 - Valve is held closed by a spring, and was opened by applying voltage to an electrommagnetic actuator
 - Design mistake in the electrical control system

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TMI Example

- Valve Indicator System
 - Operation: Open/Close
 - Big problem?



Valve Indicator System Actually Designed

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TMI Example

- Actual Position of the Valve???
- Problem
 - After the pressure-relief operation, the valve became stuck in the open position
 - Although the actuation voltage had been turned off and lights in the control room indicated that the valve was closed (it was actually stuck open)
 - Mechanical spring for closing the valve did not have enough force to overcome the sticking force.
 - Operators believed that the valve was closed, and coolant leaked from the vessel for almost 2 hours

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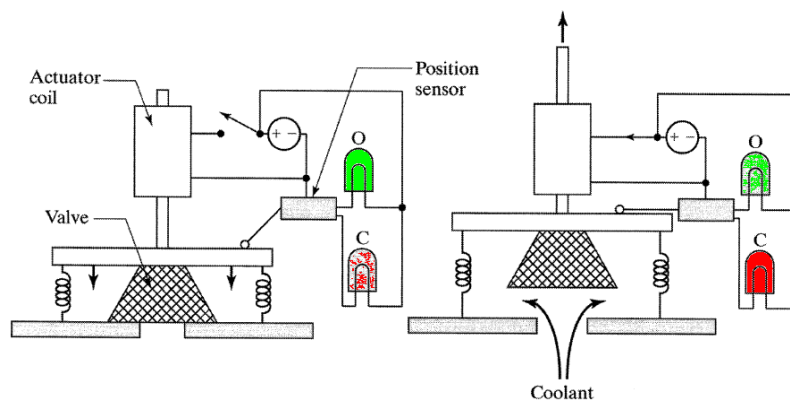
TMI Example

- Ultimate test of a system occurs during an emergency
- Absolutely accurate information is critical
 - Operators assumed that the information they were receiving was accurate, while in reality it was not.
- Direct confirmation must have been done instead of just by inference
- Better Design?
 - Unambiguous verification of the true position of the valve
 - How to redesign it?

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TMI Example - HW

- Design the position sensor box so that the lights and the actual position always match.
- Due: Next Wednesday



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