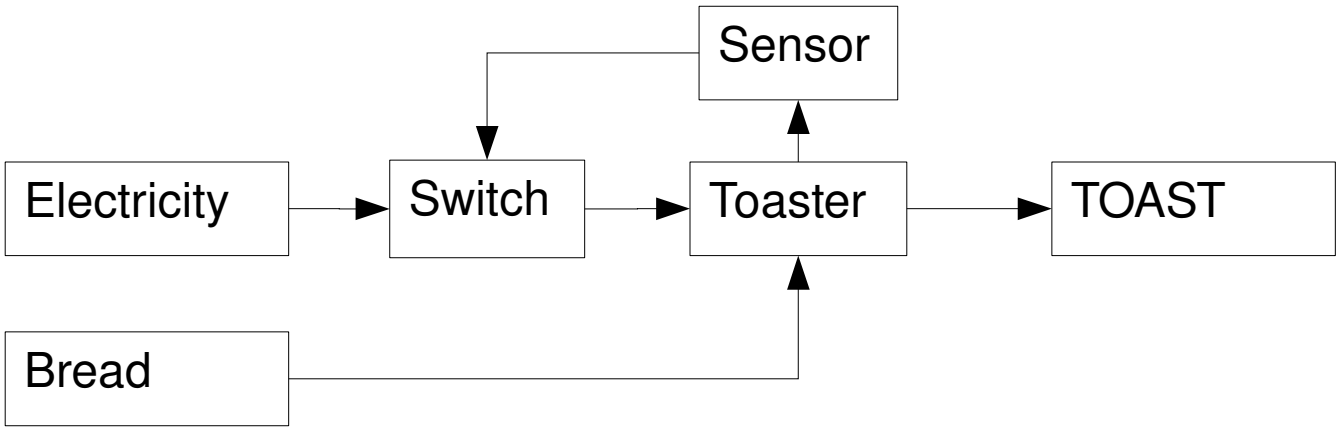
Failure Mode Effect Analysis

The purpose – To evaluate what would happen if any component of a system fails, how the system as a whole would react and implications it would have. This allows you to determine and prioritize risks, and to determine what action should be taken to eliminate or reduce that risk.... it's a methodical risk assessment which deals with component failure.... usually used in complex systems where if the system failed there would be a risk to the local population, e.g. a refinery, chemical works, power station.

Rather than using a complex system to demonstrate this and cause confusion let's start with a simple system.

For example, here is a system to make toast using an electric toaster :-




A System for Failure Mode Events Analysis

Steps in analysis

1 **Make a list of the various components in the system**

2 **For each component note what could cause a failure of the component. Restrict this to reasons that are likely, so no meteorite strikes. This is the Failure Mode**

3 **Decide what effect the failure of the component would have. This is Effects Analysis**

4 **Prioritise the risks associated with the failure and the effects it has by assigning a Risk Priority Code – ie decide which risks are most important and prioritize them.**

5 **A more methodical way of prioritizing which failure modes are dealt with first is to calculate and assign a Risk Priority Number, as follows:-**

a) How likely is it that the component will fail (occurrence) 1 is very unlikely – 10 is very likely.
b) Would the consequences be severe (from a health & safety perspective), 1 is minor – 10

is a catastrophy... different organisations will perceive these subjective measures differently.... so it's what suits your organisation... on fan dying in a football stadium is much less severe than the Hillsborough disaster, but in my company of 56 employees, one death would be catastrophic. Anyway that's Severity

c) When an important component fails, there should be a system to detect it, an alarm, a warning light, an automatic shutdown, a pressure release valve, someone periodically checking a guage. This is Detection and it is numbered from 1 – remote chance it will go undetected, to 10 – very unlikely to be detected.

d) Multiply occurrence, Severity and detection figures together and this gives you the Risk Priority Number.... you note this against each Failure Mode, and this allows you to sort the list of possible component failures in order of most significant risk.

**6 Determine methods of dealing with the risks.**

| ITEM | COMPONENT | FAILURE MODE | EFFECT | RPC or RPN | Action to be taken |
|---|---|---|---|---|---|
| 1 | ELECTRICITY | NO SUPPLY | NO TOAST | 1 | EAT CEREAL |
| 2 | BREAD | FROZEN | UNDER TOASTED | 1 | PUT TOAST IN TWICE |
| 3 | SWITCH | JAMMED OFF | NO TOAST | 1 | EAT CEREAL, HAVE SWITCH REPLACED |
| 4 | SWITCH | JAMMED ON | AT LEAST BURN TOAST,<br>MAYBE HOUSE FIRE,<br>MAYBE BLOCK OF FLATS ON FIRE<br>POSSIBLE SINGLE OR MULTIPLE FATALITIES | 6 | IN BLOCK OF FLATS, FIT SMOKE DETECTOR IN EACH FLAT NEAR KITCHEN AND PROVIDE CO2 FIRE EXTINGUISHER<br><br>IN INDIVIDUAL HOUSES FIT SMOKE DETECTOR |
| 5 | SENSOR | NOT DETECTING | KEEP SWITCH ON, SEE ITEM 4 | 6 | SEE ITEM 4 |
| 6 | SENSOR | FALSE DETECTION | KEEP SWITCH OFF, SEE ITEM 3 | 1 | SEE ITEM 3 |
| 7 | TOASTER | NOT HEATING UP | USER MAY TRY TO REMOVE BREAD USING METAL IMPLEMENT,<br>ELECTROCUTION,<br>SINGLE FATALITY | 5 | PREVENT BREAD FROM STAYING DOWN UNLESS POWER IS ON AND HEATING ELEMENT IS NOT BROKEN.<br>FIT FUSE IN SUPPLY<br>FIT RCD CUT OUT |
| 8 | TOASTER | NOT RELEASING TOAST | BURNT TOAST<br>POSSIBLE USER MAY TRY TO REMOVE TOAST USING A METAL IMPLEMENT<br>POSSIBLE FIRE | 5 | DESIGN TOASTER SO THAT THERE ARE NO EDGES UNDER WHICH TOAST CAN JAM.<br>PROVIDE A RELEASE BUTTON<br>SEE ITEM 7 |

As you can see from this example, it is important that all the possible failure modes for a component are considered.