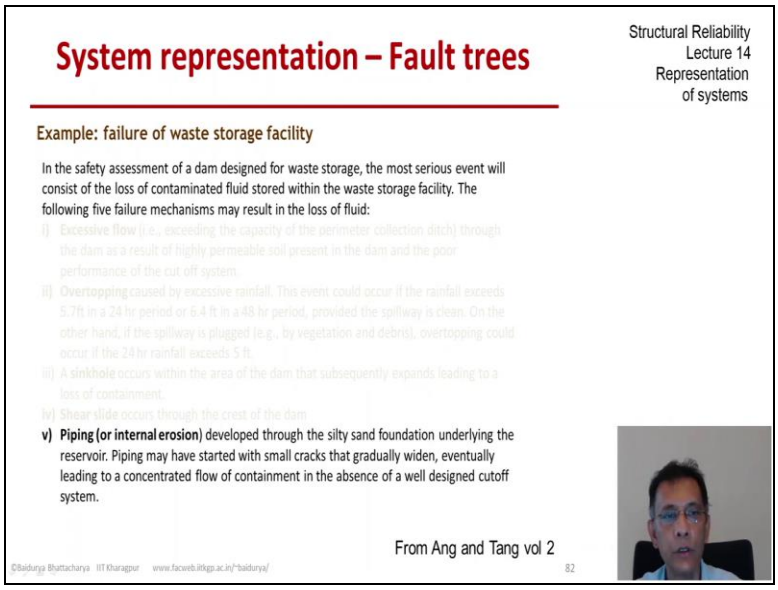
**Structural Reliability**
**Prof. Baidurya Bhattacharya**
**Department of Civil Engineering**
**Indian Institute of Technology, Kharagpur**

**Lecture –117**
**Representation of Systems (Part -21)**

**(Refer Slide Time: 00:27)**

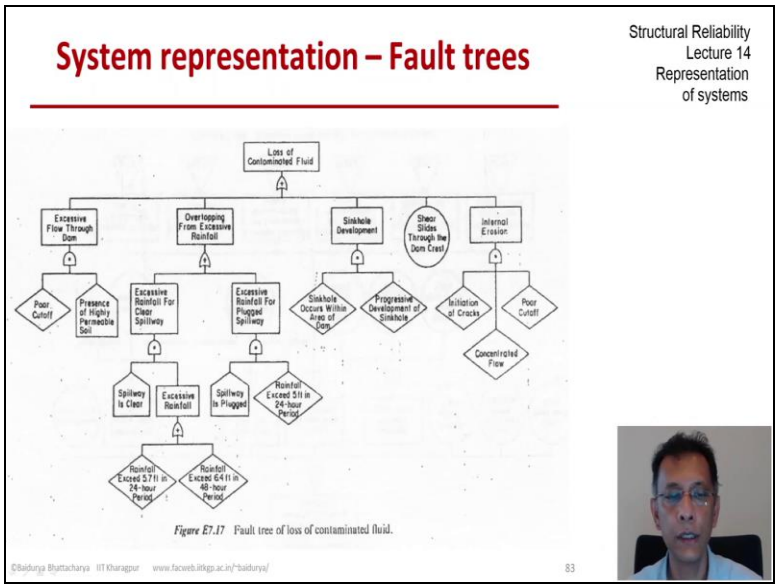



In the next three slides let us take a look at how to convert a set of high level engineering statements about the performance of a system can be converted into the corresponding fault tree for the system. So, the first example is a toxic wastewater storage facility. And let us look at the failure modes one by one. These are a bit wordy. So, if you would like to pause the video and take your time readings please do so.

So there are 5 failure mechanisms the first is excessive flow and you see the definition there the second is over topping caused by excessive rainfall and there are a few qualifiers there and the details are there on your screen. The third failure mode is the occurrence of a sinkhole the fourth failure mode is occurrence of shear slide and the last failure mode listed is internal erosion and there are two possibilities there.

So, once we understand these we are in a position to draw up the high level fault tree of this particular system.

**(Refer Slide Time: 02:27)**

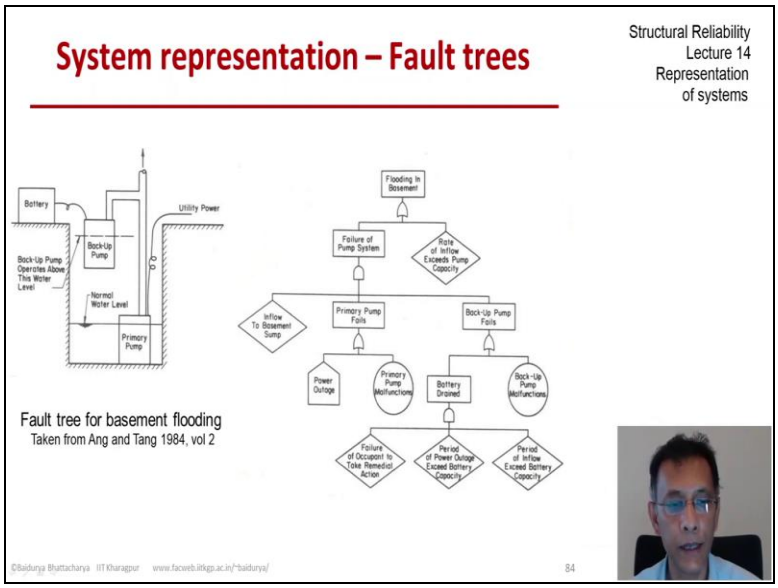



So, the top event is the loss of contaminated fluid and the 5 failure modes are listed there and they are all going through the or gate. So, any one of them is enough to cause system failure now we will convert those statements corresponding to each failure mode in terms of further events. So the first one has two one is a house type event and the other is a undeveloped event. So, we do not need to look at them any further in the over topping failure mode we have two possibilities again going through an OR gate excessive rainfall with the clear spillway or excessive rainfall with plugged spillway.

And each of them has their own set of conditions which keeps going down and down until we reach a set of undeveloped events a set of diamonds or the house in the diamonds. So, that no further development is necessary for the sinkhole the third failure mode we have two diamonds uh. So, no further development is necessary the shear slide the fourth failure mode has no for the development at all.

So, it is an elemental failure and then the final failure mode is internal erosion and that has three events going through an AND gate. So, but each of them has no further development that is necessary.

**(Refer Slide Time: 04:38)**




The next example converts a similar water related problem flooding in a in a basement sump pump system and we will just look at this diagram it is a nice diagram taken from hang and tang look volume two and it is possible to convert this into a fault tree. So we have the top event flooding in basement that can happen either if the pump system fails or the inflow exceeds the pump capacity and then that second event requires no further development.

So, we will just look at the first event the failure of the pump system and that has several possibilities they are all going through an AND gate. So, the inflow to basement sump and then the primary pump fails and the backup pump also fails and then those events the pump failure events the primary and the backup pump failure events are further developed into either up to a house event or an elemental failure or other time and events which require no further development.